

GHANA RUBBER ESTATE LIMITED



FINAL UPDATED ENVIRONMENTAL IMPACT ASSESSMENT (EIS) FOR THE PROPOSED CONSTRUCTION AND OPERATION OF A NATURAL RUBBER PROCESSING PLANT

Prepared by:

KB & Associates (Ghana) Limited
P.O. Box KN 4228 Kaneshie
Accra, Ghana
E-mail: kb_asso@yahoo.com

Submitted to:

Environmental Protection Agency
Accra.

August, 2018

TABLE OF CONTENTS

NON TECHNICAL SUMMARY.....	5
1.0 Introduction.....	12
1.2 EIA Study Objectives.....	13
1.3 Project Justification.....	13
1.4 Project Site Selection Options.....	14
1.4.1 NoAction Alternative.....	14
1.4.2 Alternative Sites Considered.....	14
1.5 Legal and Regulatory Framework.....	15
1.5.1 Other Legal and Legislative Conditions.....	18
1.5.2 Relevant National Environmental Guidelines.....	18
1.6 Environmental Impact Assessment (EIA) Procedure.....	19
1.7 Methodology of the Assessment.....	21
1.8 Layout of EIS.....	22
1.9 Project Ownership.....	24
2.0 PROJECT DESCRIPTION.....	25
2.1 Project Concept.....	25
2.2 Project Implementation.....	25
2.2.1 Pre-Constructional Phase Activities.....	25
2.2.2 Constructional Phase of Project.....	25
2.2.3 Operational Phase Activities.....	26
2.3 Operational Machinery.....	34
2.4 Source of Energy.....	34
2.5 Water Supply.....	34
2.6 Labour Requirement.....	35
3.0 BASELINE INFORMATION OF THE PROJECT LOCALITY.....	36
3.1 Project Location and Accessibility.....	36
3.2 Existing Site Conditions.....	37
3.3 Land Use Zoning.....	38
3.4 Climatic Conditions.....	38
3.4.1 Rainfall.....	38
3.4.2 Temperature and Wind Velocity.....	38
3.4.3 Relative Humidity and Evaporation.....	39
3.5 Environmental Quality Monitoring.....	39
3.5.1 Air Quality.....	39
3.7.2 Noise Level.....	41
3.8 Geology and Soils.....	43
3.9 Vegetation.....	43
3.10 Topography.....	43
3.11 Drainage.....	43
3.12 Socio-economic Environment.....	44
4.0 IMPACT IDENTIFICATION AND ASSESSMENT.....	48
4.1 Method of Identification of Impacts.....	48
4.1.1 Pre-Constructional Phase Impacts.....	50
4.1.2 Constructional Phase Impacts.....	51

4.1.3	Operational Phase Impacts.....	51
4.1.4	Closure Phase	51
4.2	Evaluation of Impacts	52
4.2.1	Construction Phase.....	52
4.2.2	Operational Phase Impacts.....	55
5.0	MITIGATION MEASURES.....	60
5.1	Constructional Phase.....	60
5.1.1	Management of Vegetation Clearance	60
5.1.2	Dust Control.....	60
5.1.3	Noise.....	61
5.1.4	General Waste Management	61
5.1.5	Occupational Health and Safety Concerns.....	61
5.2	Operational Phase	62
5.2.1	Odour Management	62
5.2.2	Wastewater Management.....	64
5.2.3	Solid Waste Management	69
5.2.4	Waste Oil Management	70
5.2.5	Noise.....	70
5.2.6	Fire Preventive Measures	70
5.2.7	Occupational, Health and Safety Concerns.....	71
5.2.8	Gaseous Emissions	72
6.0	ENVIRONMENTAL MONITORING PROGRAMME	74
6.1	Introduction.....	74
6.2	Monitoring Principles and Objectives.....	74
6.3	Data Handling and Reporting	75
6.4	Management Measures	75
6.4.1	Odour Nuisance and Air Quality Management Measures.....	75
6.4.2	Wastewater Management Measures	76
6.4.3	Solid Waste Management Measures	76
6.4.4	Waste Oil Management Measures.....	76
6.4.5	Noise Control Management Measures.....	77
6.4.6	Occupational Health and Safety Management Measures.....	77
7.0	PROVISIONAL ENVIRONMENTAL MANAGEMENT PLAN	79
7.1	GREL's Health, Safety and Environmental Policy	79
7.2	Environmental Staffing	80
7.3	Monitoring Programme	80
7.4	Financial Allocations	81
7.5	Decommissioning Plan.....	81
7.6	Emergency Response Plan.....	81
7.7	Documentation and Reporting	85
7.7.1	Types of Reports	86
8.0	PROVISIONAL DECOMMISSIONING AND CLOSURE PLAN	87
8.1	Closure Objectives	87
8.2	Decommissioning Plan.....	87
9.0	CONSULTATIONS.....	89
9.1	The Environmental Protection Agency (EPA).....	89
9.2	Physical Planning Department	89
9.3	Water Resources Commission	90

9.4	Ahanta West Municipal Assembly	90
9.4	Association of Chiefs on whose land GREL Operates	90
10	CONCLUSIONS.....	91
	LIST OF APPENDICES.....	92

LIST OF TABLES

Table 2. 1:	Annual Raw Material Consumption.....	28
Table 3. 1:	Summary of Air Quality Results over 24-Hour Period.....	42
Table 3. 2:	Summary Results of Noise Levels	42
Table 4. 1:	Scoring system for evaluating impacts for proposed development	49
Table 4. 2:	Significance Scale.....	50
Table 5. 1:	GREL design basis and expected treatment performance.....	67
Table 6. 1:	Action Plan and budget for Environmental Management	78

LIST OF FIGURES

Figure 1. 1:	Ghanaian EIA Process Flow (Environmental Assessment Regulations, 1999).....	20
Figure 2. 1:	Proposed Project Infrastructure Layout	27
Figure 2. 2:	Proposed Environmentally Flow Diagram	33
Figure 5. 1:	Wastewater Treatment Flow Chart.....	68

LIST OF PLATES

Plate 2. 1:	Existing Transformer (arrowed) at the Abura Site	34
Plate 2. 2:	Existing dam at the Abura site.....	34
Plate 3. 1:	Abura Project site located along the Takoradi along the Axim road.....	36
Plate 3. 2:	Access to the Proposed Project area through the Rubber Plantation within the Abura site	37
Plate 3. 3:	A section of the Proposed Project site showing Rubber Plantation.....	37

LIST OF APPENDICES

Appendix 1: Project Site Plan

Appendix 2: EPA Correspondences

Appendix 3: GREL Correspondence to WRC

Appendix 4: List of Project Machinery with installed capacities

Appendix 5: Emergency Response Plan

ABBREVIATIONS

BOD	-	Biological Oxygen Demand
BMP	-	Best Management Practice
COD	-	Chemical Oxygen Demand
EIA	-	Environmental Impact Assessment
EA	-	Environmental Assessment
EQ	-	Environmental Quality
EIS	-	Environmental Impact Statement
GREL	-	Ghana Rubber Estates Limited
GSB	-	Ghana Standards Board
ILO	-	International Labour Organization
LI	-	Legislative Instrument
MSDS	-	Material Safety Data Sheets
PNDC	-	Provisional National Defence Council
TOR	-	Terms of Reference
WRC	-	Water Resources Commission

NON TECHNICAL SUMMARY

Background

Ghana Rubber Estates Limited (GREL) has been involve in the cultivation of rubber plantation in Ghana since 1957. The Company's current operations basically involves the cultivation of rubber, enhancement and management of rubber plantations as well as the processing of natural rubber for export into mainly Europe, Asia, Far East and America markets and the local market as well. GREL was certified as an ISO 9001:2008 quality management systems in 2014.

The company currently operates a 10t/hr natural rubber processing factory at Apimenim in the Ahanta West District of the Western Region. The factory processed a total of 36,645 (drc) crumbed natural rubber in 2016. GREL wants to expand on the processed crumbed natural rubber by the construction and operation of a new 10t/hr natural rubber processing plant at the company's Abura site also in the Ahanta West District of the Western Region.

EIA Purpose

The Environmental Impact Assessment (EIA) for the construction and operation of the natural rubber processing plant has been prepared in accordance with the guidelines of the Environmental Protection Agency (EPA). The proposed project has been registered with the EPA under the Environmental Assessment Regulations 199 (LI 1652).

The proposed study will assess the environmental, social and other related impacts of the construction and operation of the facility. In addition, the study will serve as Permitting requirement for EPA as the regulatory agency, and will also meet the company's value of "respect for the environment" for sustainable development.

Legal and Regulatory Requirements

The relevant legal, regulatory and guidelines applicable to the proposed project that has been considered in the assessment includes:

- Environmental Protection Agency Act, 1994 (Act 490)
- Environmental Assessment Regulation, 1999 (LI 1652)
- National Building Regulations, 1996 (LI 1630)
- Fees and Charges (Amendment) Instrument 2015 (LI 2228)

- Hazardous and Electronic Waste Control and Management, Act 2016 (Act 917)
- Hazardous, Electronic and Other Waste (Classification) and Management Regulations 2016, LI 2250
- Water Resources Commission, Act 522, (1996)
- Ghana Investment Code, 1985 (PNDC Law 116)
- Ghana Investment Promotion Act, 1994, Act 478
- Water Resources Commission;
- Ghana Investment Promotion 1994, Act 478
- Water Use Regulations, 2001, (LI 1692)
- Workmen's compensation Law, 1987
- Land (Statutory Wayleaves) Act, 1963 (Act 186)
- Ghana Occupational Safety and Health Policy, 2004 (Draft) and
- Labour Act, 2003 (Act 651).

Other Legal and Legislative Conditions

The proposed construction and operation of the natural rubber processing facility is also required to satisfy the following legislations:

- Factories, offices and shops Act, 1970 (Act 328);
- Fire Precaution (Premises) Regulation, 2003 (LI1724);
- Town & Country Planning Ordinance of 1945;
- Road Traffic Act, 2004, (Act 683).
- Ghana National Fire Service Act, 1997, (Act 537) and
- Ahanta West District by-laws on Noise and Sanitation.
- Local Government Act, 2016 (Act 936) and
- Building Regulations of Local Authorities passed under the local Government Legislative.

Description of the Proposed Project

GREL intends to construct a 10t/hr rubber processing plant for the processing of natural rubber. The processing involves mainly blending cuplumps, granulation, milling, drying and packaging.

Raw materials used for the processing come from the following two (2) different sources:

- Company's own 12,000 Ha plantation –(Central Estates and Monitored Estates) and
- Outgrower farms – Outgrowers

The proposed 10t/hr natural rubber processing plant will mirror the existing 10t/hr plant located at Apimanim and will consist of the following primary components:

- Reception area;
- Pretreatment line;
- Maturation area;
- Blending area;
- Wet line;
- Drying line;
- Packaging line;
- Warehouse and
- Loading bay

The proposed production process involves the preparation (removal of contaminants and blending to achieve homogeneity) of cuplumps, granulation, milling, drying and packaging.

Baseline Information of the Study Area

Project Location and Accessibility

The proposed new natural rubber processing plant will be located on a 123.5 acres at Abura, in the Ahanta West District of the Western Region of Ghana. The company's operational office is also located at Abura. The proposed Project will be located within GREL permitted boundary rubber plantation at the Abura operational site where field activities are controlled and monitored.

The proposed Project site is accessed from 40km from Takoradi along the Axim road. From the main gate of the Abura operational office, the site can be accessed at approximately 2km through the plantation roads.

Climate

The project area is located within a sub-equator climate distinguished by a dry season from January to March and two rainy seasons (May – June and October) around a small dry season in August. The pluviometer varies from 1750 to 2000 mm per annum according to the regions. These climatic

conditions are favourable for the cultivation of Hevea, the weakest pluviometries being compensated for by sufficient depth of the grounds.

Temperature and relative humidity measurements obtained from the Ghana Meteorological Agency indicate high values for both these aspects and persist for most times of the year. The highest mean temperature of about 31°C is measured in February and March and the lowest temperature of 25°C is normally recorded in August, which is the coolest month within the forest region of the country. The average annual temperature is about 22°C. The movements of two air masses namely, Southwest Monsoon and Northeast Trade winds determine the climate of Ghana. These air masses get into contact with each other along the Inter-tropical Boundary. They have different air moisture and relative stability conditions and create four main climatic seasons for the country; two rainfall and two dry seasons. The average wind speed within inland areas which include a greater part of the humid forest zone encompassing the study area is generally below 8 km per hour. Such inland winds are relatively free from the influence of sea breezes but are affected by relief and by diurnal variations of heating and cooling. Wind speeds are lowest at night and during the early mornings. Wind speeds generally reach a maximum during the middle of the afternoon when average values of between 8 and 16 km per hour are experienced.

The relative humidity for the project area is highest (between 83% - 95%) early in the morning in May and June which coincides with the wet season. The relative humidity falls considerably during the main dry season and reaches a minimum during January and February.

Vegetation and Land use

The original vegetation cover of the project area was a tropical forest. Currently the area is covered with approximately 13,000 Ha of rubber plantation, offices, dam and ancillaries.

Topography

The main landscape varies from undulated to cut by valleys with vast plateau areas. The grounds are usually deep, clay-sandy to sand-clayey with at some places rocky levellings. The ground texture is totally favourable for the cultivation of Hevea (rubber tree) when there are no hydromorphic grounds or indurations (lateritic spots or gravel compact horizons) too near the surface.

Drainage

The major rivers in the area include: the Suoni River, Nyani River, Yeresuro River, Apusire River and Duobun River and the Tsibu stream. However, an existing dam that is fed by the Tsibu stream used for the purposes of rubber nursery irrigation will also serve as the source of water supply for the proposed processing plant.

Socio-economics

Abura falls within the jurisdiction of the Ahanta West District of the Western Region of Ghana. The District was carved out of the former Shama Ahanta East Metropolitan Assembly now Sekondi–Takoradi Metropolitan Assembly, in 1988 as per L.I.1395.

The District covers a land area of 591 square kilometers. It shares boundaries with Nzema East Municipal on the West, Tarkwa–Nsualem Municipal and Mponoh Wassam–East to the north, and Sekondi–Takoradi Metropolitan Assembly to the East. It is bordered on the south by the Gulf of Guinea. The southernmost part of Ghana lies in the district at Cape Three Points. The District is about 15 minutes' drive from the commercial capital of the Western Region, Takoradi and 25 minutes' drive from the administrative capital, Sekondi. In terms of distance, it is approximately 25 kilometers from the central business district of Takoradi. This proximity to the central business district of Takoradi enhances business and trade in particular.

Environmental Impacts and Mitigation Measures

Constructional Phase Impacts

The following impacts are likely to be emerged:

- Loss of vegetation cover (Change of landscape from the massive cutting of the rubber plantations)
- Dust Emission
- Noise Generation
- Waste Generation
- Occupational safety and health hazards
- Socioeconomic benefits from employment generation and its multiplier effect for the people of the project area as well as from the Ahanta West District of the Western Region.

Operational Phase Impacts

The impact to be associated with the project operational phase includes:

- Generation of high level of odour
- Generation of effluent
- Generation of solid wastes
- Waste oil and chemicals contamination
- Noise generation at the milling, drying sections, diesel generators
- Increased risk of fire
- Occupational health and safety concerns and
- Increased concentration of gaseous emissions from equipment exhaust, additional generators, and rubber processing plant.

Management have instituted measures to mitigate all the identified impacts.

Monitoring Activities

Monitoring will take place in all the phases of the project construction and operational phases of the project. The following parameters will be monitored:

- Oduor nuisance/Air Quality.
- Wastewater.
- Solid waste.
- Waste oil.
- Noise control and
- Occupational Health and Safety.

The continuous monitoring will confirm the validity of impact predictions and demonstrate the compliance of management and workers with all regulations that pertain to the safety, health and environment.

Provisional Environmental Management Plan

To ensure that operations of the proposed project are implemented in an environmentally friendly manner whilst ensuring a rapid and effective response to any eventualities, management of GREL shall put in place a Provisional Environmental Management Plan. The plan will consist of the following:

- An organizational structure, i.e., a line of authority leading from the facility manager with clearly defined roles and responsibilities
- Maintenance and training schedules in environmental and occupational issues will be established
- Emergency response action plan shall be put in place
- Health and welfare of all personnel will be catered
- Adequate budget shall be allocated to implement the above schemes

Consultations

Consultations have been held with all relevant stakeholders. Concerns and comments raised through these consultations have been addressed in the EIS. The following are the stakeholders consulted.

- Environmental Protection Agency (EPA);
- Ahanta West District Assembly (AWDA);
- Water Resources Commission;
- Physical Planning Department of AWDA;
- Water Resources Commission;
- Ghana Water Company Limited;
- Electricity Company of Ghana and
- Association of Chiefs on whose land GREL Operates.

Conclusions

It is anticipated that the adoption of the above environmental management measures will make the project environmentally sound and safe and also warrant the issuance of an environmental permit to operate the facility.

1.0 INTRODUCTION

Ghana Rubber Estates Limited (GREL) has been involve in the cultivation of rubber plantation in Ghana since 1957. The Company's current operations basically involves the cultivation of rubber, enhancement and management of rubber plantations as well as the processing of natural rubber for export into mainly Europe, Asia, Far East and America markets and the local market as well. GREL was certified as an ISO 9001:2008 quality management systems in 2014.

The company currently operates a 10t/hr natural rubber processing factory at Apimenim. The factory processed a total of 36,645 (drc) crumbed natural rubber in 2016. GREL wants to expand on the processed crumbed natural rubber by the construction and operation of a new 10t/hr natural rubber processing plant at the company's Abura site (**Appendix 1**) in the Ahanta West District of the Western Region.

As required by the environmental laws of Ghana, a project of this nature would require an Environmental Impact Assessment to ensure that the project do not have any adverse effects on the environment and the communities within the project environs.

In compliance with Ghana's environmental policy stipulated in Environmental Protection Agency (EPA) Act, 1994 (Act 490), and subsequent Legislative Instrument (LI) 1652 of 1999, GREL commissioned KB & Associates (Ghana) Limited to conduct the environmental assessment on the proposed project in order to obtain an Environmental Permit which is a prerequisite for the Project's establishment.

GREL has submitted a scoping report and draft Terms of Reference (TOR) to the EPA. This was approved and paved the way for the conduct of the Environmental Impact Assessment (EIA). The results of the EIA is this Environmental Impact Statement (EIS).

This EIS document covering the construction and operation of the natural rubber processing plant has been prepared based on the Scoping Report draft Terms of Reference, concerns and comments from the Ghana EPA, consultations from relevant stakeholders and GREL sponsored baseline environmental and social studies of the study area as well as information from other similar established operations.

1.2 EIA Study Objectives

The objectives of this EIS are as follows:

- Provide adequate description of the proposed project and identify all activities of environmental/social concern;
- Establish the existing environmental and socio-economic baseline conditions of the project area of influence;
- Predict and examine all the significant environmental impacts on the surrounding communities and the general environment during implementation of the proposed project and advise on appropriate mitigation and abatement measures against potential adverse impacts;
- Provide a monitoring programme for predicted impacts in a provisional Environmental Management Plan (EMP) framework; and
- Document the socio-economic and cultural advantages and disadvantages associated with the proposed project for stakeholders and interested groups to make an informed decision on the level of environmental compromise and permitting.

1.3 Project Justification

The high global demand for natural rubber has been consistently on the rise. Global consumption of natural and synthetic rubber, pegged at 12.3 and 16.8 million tonnes, respectively, in 2015, was an increase of 3.1 percent and 0.9 percent from 2014. It is projected to reach 15 and 19.4 million tonne by 2020. This is the primary justification for the development and operation of proposed new natural rubber processing plant.

Other secondary justifications include:

- Conducive investment climate in the country;
- Availability of raw material and
- Availability of skilled manpower.

The project will also generate additional revenue to Government in the form of royalties paid taxes on profits and employees' salaries and wages.

1.4 Project Site Selection Options

Alternatives were considered by GREL in its evaluations of various components of the proposed Project, to reduce potential impacts on the environment and social conditions, and to optimise engineering aspects of the proposed natural rubber processing project.

1.4.1 No Action Alternative

In the event that GREL does not receive requisite approvals from the Regulatory Institutions for the construction and operation of the proposed natural rubber processing plant, then the company will not be able to increase its processed rubber for supply to the already existing high global demand market.

In the light of this consideration, GREL will not construct and operate the proposed natural rubber processing plant and thereby losing the envisaged financial gains from the proposed project. The surrounding communities also stand to forfeit social investment packages in livelihood support and community assistance programs that could accrue to the community including further job losses in the rubber supply chain and reduce local economic growth and revenue generation.

1.4.2 Alternative Sites Considered

A number of project alternative sites were considered including expanding the existing Apimanim plant and a site around Apimanim community. The choice of alternative sites is limited by the presence of settlements in proximity to the proposed sites.

The preferred Abura site was dictated by the following reasons:

- Located within the GREL agriculture and industrial zoned permitted plantation boundary;
- Located in an area not currently used as farmland;
- Located in an area that will not require resettlement of people; and
- Located in an area that is further away from any human settlement.

1.5 Legal and Regulatory Framework

The construction and operation of the proposed natural rubber processing plant will require the conduct of Environmental Impact Assessment (EIA) to ensure that the project does not have any adverse effect on the environment and communities around the project area. The Environmental Protection Agency Act, 1994 (Act 490) and Environmental Assessment Regulation, 1999 (LI 1652) makes EIAs a mandatory requirement for all project undertakings of such nature. The under listed section of the Act and Regulations further explain the above points:

- Environmental Protection Agency Act, 1994 (Act 490) section 12 (1) states that: “The Agency may by notice in writing require any person responsible for any undertaking which in the opinion of the Agency has or is likely to have adverse effect on the environment to submit to the Agency in respect of the undertaking an EIA containing such information within such period as shall be specified in the notice”.
- The Environmental Assessment Regulations, 1999 (LI 1652), Part 1, Regulation 1 states that: “No person shall commence any undertakings to which a matter in the Schedule relates, unless prior to the commencement, the undertaking has been registered by the Agency and an environmental permit has been issued by the Agency in respect of the undertaking”.
- Regulation 2 also states that: “No person shall commence activities in respect of any undertaking, which in the opinion of the Agency has or is likely to have adverse effect on the environment or public health unless, prior to the commencement, the undertaking has been registered by the Agency in respect of the undertaking”.

Other relevant regulatory and policy requirements with respect to the proposed project include:

- **National Building Regulations, 1996 (LI 1630).** The National Building Regulation (L.I. 1630), made up of nineteen (19) parts and one hundred and eighty seven (187) regulations, is a set of rules and standards that must be followed to satisfy the minimum acceptable levels of safety for buildings and non-building structures. It is applicable to the erection, alteration or extension of any building. The District Planning Authority (DPA) is mandated by L.I. 1630 to implement the regulations on behalf of every local authority. Extracts from the Regulation states that “Save as is otherwise provided by Regulation 114, no person shall begin to construct any building or to execute any work except under and in accordance with the terms and conditions of a permit in the prescribed form signed by the Metropolitan Engineer (hereinafter called a “building permit”) and also “The Metropolitan/Municipal/District Engineer may require an applicant to submit a plan,

sections, elevations, calculations and drawings and such description of materials to be used as the Engineer may think necessary”.

- **Fees and Charges (Amendment) Instrument 2015 (LI 2228)** replaces the Fees and Charges (Amendment) Instrument, 2014 (LI 2216), and gives regulation to the fees and charges (Miscellaneous Provision) Act 2009, Act 793. The law provides a comprehensive rates, fees and charges collectable by Ministries, Department and Agencies (MDAs) for goods and services delivered to the public.
 - **Hazardous and Electronic Waste Control and Management, Act 2016 (Act 917):** A person shall not except as otherwise provided in this Act (a) import or cause hazardous wastes or other wastes to be imported into the country; (b) export or cause hazardous waste or other waste to be exported out of the country; (c) transport or cause to be transported hazardous wastes or other wastes that has been imported into the country or that is in transboundary movement through the country; or (d) sell, purchase or deal in hazardous wastes or other wastes.
 - **Water Resources Commission, Act 522, (1996)** established the Commission, empowers the Commission as the sole agent responsible for regulation and management of the utilization of water resources in the country. The Commission does this through granting of water rights.
7. **Section 13 of Act 522** states that “No person shall divert a dam, store, abstract or use water resources; constructs or maintains any works for the use of water resources except in accordance with the provision of this Act”.
- **Ghana Investment Code, 1985 (PNDC Law 116).** PNDC Law 116 which established the Ghana Investment Code, requires that the Ghana Investment Centre, as the agent responsible for the encouragement, promotion and coordination of private investment in the country, must in appraisal of proposed investment projects in the country, have regard to any effect the undertaking is likely to have on the environment and measures proposed for prevention and effective control of any harmful consequences the proposed undertaking will have on the environment.

- **Water Use Regulations, 2001, (LI 1692)** prohibits the use of water resources without authority from Water Resources Commission. Section 16 of this regulations stipulates the application procedure for grant of water use right.
- **Workmen's compensation Law, 1987** holds employers responsible for the payment of compensation to workmen for personal injuries caused by accidents arising out and in the course of their employment.
- **Land (Statutory Wayleaves) Act, 1963 (Act 186)** details the process involved in the occupation of land for the purpose of the construction, installation and maintenance of works of public utility, and for the creation of rights of way for such works. Where the President is of the opinion that it is in the public interest that a right of way or any other similar right over a land be created in respect of the whole or a part of any works specified in section 2, the President may, subject to this Act, by executive instrument, declare the land specified in the instrument to be subject to the statutory wayleave specified in the instrument. Further to this act, the statutory wayleaves registration 1964 provides procedural details and grievance redress mechanism.
- **Ghana Occupational Safety and Health Policy, 2004 (Draft)** “is to prevent accidents and injuries arising out of or linked with or occurring in the course of work, by minimizing, as far as reasonable practicable, the cause of the hazards in the working environment and, therefore, the risk to which employees and the public may be exposed”. The policy is derived from the provision of the International Labour Organization (ILO) Convention 155 and 161. The key objective is to ensure the safety, health and welfare of persons at work as well as other persons not at work, but may be affected by the activities of persons at work by preventing or minimizing the cause of hazards through tripartite collaboration and cooperation. The policy document has specific sections on objectives, scope, strategies, activities and promotion and awareness creation.
- **Labour Act, 2003 (Act 651):** The purpose of this Act is to amend and consolidate existing laws relating to labour, employers, trade union and industrial relations as well as to establish a National Labour Commission. The Act provides for, among others, the right and duties of

employers and workers: what is legal or illegal strike: guarantees trade unions and freedom of associations, and establishes the labour Commission to mediate and act in respect of all labour issues. Under Part XV (Occupational Health and Safety and Environment), the Act explicitly that it is the duty of an employer to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions.

- **Ghana Investment Promotion Act, 1994, Act 478:** The Ghana Investment Promotion Centre Act 1994 (Act 478) requires that every investor wishing to invest in the country must in its appraisal of proposed investment projects or enterprises, "...have regard to any effect the enterprise is likely to have on the environment and measures proposed for the prevention and control of any harmful effects to the environment...".

1.5.1 Other Legal and Legislative Conditions

The construction and operation of the proposed natural rubber processing plant is also required to satisfy the following legislations:

- Factories, offices and shops Act, 1970 (Act 328);
- Fire Precaution(Premises)Regulation, 2003 (LI1724);
- Town & Country Planning Ordinance of 1945;
- Road Traffic Act, 2004, (Act 683).
- Water Resources Commission;
- Town and Country Planning (Amendment) Act, 1960 (Act 33).
- Ghana National Fire Service Act, 1997, (Act 537) and
- Ahanta West District Assembly by-laws on Noise and Sanitation.
- Local Government Act, 2016 (Act 936); and
- Building Regulations of Local Authorities passed under the local Government Legislative.

1.5.2 Relevant National Environmental Guidelines

Environmental Assessment in Ghana, A Guide (1996), produced by the EPA, provides detailed guidance on the procedures to be adhered to when undertaking an EIA. This includes:

- **Environmental Impact Assessment Procedures,1995** produced by the EPA details the procedures to be adhered to when undertaking an EIA.

- **Environmental Quality Guidelines for Ambient Air (EPA), 1997** provides advice on maximum permissible levels of a variety of air pollutants.
- **Environmental Quality Guidelines for Ambient Noise (EPA), 1996** provides advice on the maximum permissible noise levels.
- **Sector Specific Effluent Quality Guidelines for Discharges into the Natural Water Bodies (EPA), 1997** provides maximum permissible effluent discharge concentrations for a number of parameters.

1.6 Environmental Impact Assessment (EIA) Procedure

This study has been guided by the EIA procedures existing in Ghana as illustrated in the flow chart in **Figure 1.1**.

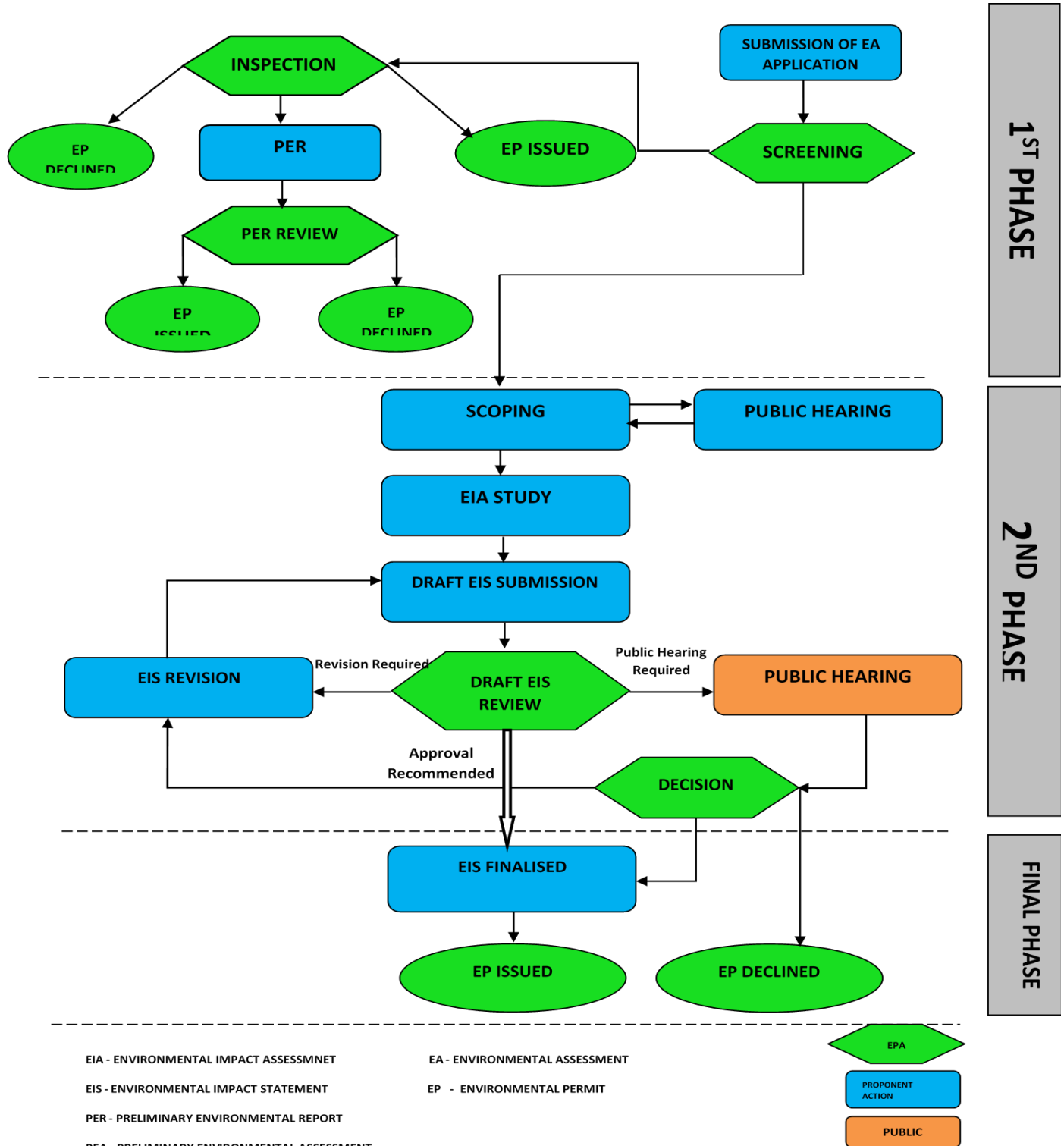


Figure 1. 1: Ghanaian EIA Process Flow (Environmental Assessment Regulations, 1999)

1.7 Methodology of the Assessment

In undertaking the EIA, full and regular liaison has been maintained with the EPA throughout the assessment process.

A formal scoping exercise has been undertaken and a scoping report was produced and submitted to the EPA in November 2017. The scoping report was conducted in accordance with LI 1652 and sets out the terms of reference for the EIA for the Project.

This EIS therefore considers the potential environmental impacts of the proposed construction and operation of the natural rubber processing plant project activities, as identified within the scoping stage of the project, through construction, operation and decommissioning phases.

The following outlines the general methods, which have been used in this EIA for the development of the EIS. The layout of the report is outlined in Section 1.9 of this report.

Field Reconnaissance study

Site visits and observation of the project sites were carried out to confirm relevant baseline environmental issues and conditions to be affected or are likely to develop from the proposed project implementation.

Specialist Studies

The following specialist studies were undertaken during the Impact Assessment Phase of the EIA:

- Flora and Fauna assessment: in respect of the vulnerability of the local ecology and biodiversity to potential impacts from the proposed project, as well as proposed mitigation measures;
- Noise assessment: in respect of the significance of potential noise generation by the proposed project, as well as proposed mitigation measures;
- Air Quality Assessment: the existing air quality of the project area including the wind direction and wind speed were monitored as part of the baseline data gathering.
- Socio-economic assessment: in respect of the potential social benefits and negative impacts

from the proposed project, as well as proposed mitigation measures.

- Surface Water, sediment and groundwater assessment: A considerable amount of knowledge exists in relation to the proposed project footprint (and immediate surroundings), and it is vitally important that this information informs the development of the surface and groundwater investigation.

Stakeholder Engagement and Consultations

Consultations have been held with the following relevant stakeholders and interested groups. Concerns/issues raised are presented in **Chapter 9**.

- Environmental Protection Agency (EPA);
- Ahanta West District Assembly;
- Physical Planning Department;
- Water Resources Commission;
- Ghana Water Company Limited;
- Electricity Company of Ghana
- Chiefs, elders and opinion leaders of the project area and
- Association of Chiefs on whose land GREL Operates.

Review of Available Literature

The major documents reviewed include:

- Climatic and weather data from the Takoradi meteorological station; and
- GREL project concept document.

1.8 Layout of EIS

In accordance with regulations 11 to 13 of the Environmental Assessment Regulations of 1999 (LI 1652) and Ghana's Environmental Impact Assessment procedures of 1995, this EIS incorporates a series of chapters describing various aspects. This has been presented in the following chapters as required by the Ghanaian Environmental Protection Agency (EPA) as follows:

Executive Summary

The executive summary presents a non-technical description of the entire project proposal, baseline information, predicted environmental and social impacts, proposed mitigation measures and measures.

Chapter 1: Introduction

This chapter outlined the following:

- Project objectives, justification and alternatives sites considered;
- General Environmental Framework for the EIA project
- EIA procedure;
- Terms of Reference and scope of the EIA; and
- Methodology for the EIA and layout of the EIA

Chapter 2: Project Description

This chapter describe in details the project description with emphasis on the project implementation and components, designs, waste management and utilities.

Chapter 3: Environmental Baseline Study

This chapter deals with the description of existing baseline environment and socio-economic conditions of the project area.

Chapter 4: Impacts Identification and Assessment

Chapter four focused on the method of identification of potential impacts, potential impacts identification and evaluation in the air, land and water media.

Chapter 5: Mitigation Measures

This chapter deals with the identified environmental and social impacts proposed mitigation measures.

Chapter 6: Environmental Monitoring Programme

This chapter focused on the monitoring framework for the proposed mitigation and environmental controls measures.

Chapter 7: Provisional Environmental Management Plan (PEMP)

This chapter of the EIS presents the Provisional Environmental Management Plan (PEMP) for the proposed project.

Chapter 8: Provisional Decommissioning and Closure Plan

This chapter of the report provides discussions on decommissioning and closure for various project facilities.

Chapter 9: Consultations

This chapter of the report places emphasis on the consultations with the various relevant stakeholders.

Chapter 10: Conclusions

The conclusion of the EIA seeks to align the scope and objectives of the EIA studies to the assessment of identified environmental and social impacts and determine the adequacy of suggested control measures as a basis for decision-making.

1.9 Project Ownership

The proposed natural rubber processing plant is 100% owned by Ghana Rubber Estates Limited, a Limited Liability Company, incorporated in Ghana under companies' code, (Act 179) on 30th October 1967 and commenced business on the 21st February, 1968.

2.0 PROJECT DESCRIPTION

2.1 Project Concept

GREL intends to construct a 10t/hr rubber processing plant for the processing of natural rubber. The processing involves mainly blending cuplumps, granulation, milling, drying and packaging. The proposed project will require approximately 123.5 acres of land. The warehouses will occupy a total floor area of 17,561 m².

2.2 Project Implementation

The project implementation shall be made in three-phase set of activities.

- Pre-Constructional phase activities;
- Constructional phase activities; and
- Operational phase activities.

2.2.1 Pre-Constructional Phase Activities

The major pre-occupation of the management of GREL at this stage has been mobilization and consultations with local and traditional authorities as well as other relevant stakeholders. The project pre-constructional activities include:

- Project planning and design
- Project site inspection;
- Surveying and demarcation by a surveyor;
- Registration and initiation of permitting process at EPA to guide the impact assessment study by screening the initial application and advising on the preparation of the environmental impact assessment.
- Stakeholder consultation;
- Environmental and socio-economic baseline surveys; and
- Environmental impact assessment.

2.2.2 Constructional Phase of Project

The constructional phase activities of the proposed natural rubber processing facility is expected to be completed within 18 months after getting official permits and approvals. The construction will consist of the following activities:

- Site preparation;

- haulage to site of construction equipment and materials
- Erection of structures and
- Installation of plants and equipment
- landscaping and removal of residual constructional materials and equipment

2.2.2.1 Site Preparation

The proposed site preparation shall be undertaken to make way for the installation of plants and equipment. Site preparation in support of the proposed project will include clearing of vegetation, grubbing and salvaging growth media for future use in reclamation and construction of access road. All activities resulting in disturbance, including the construction phase of the proposed Project, will be conducted in accordance with the GREL sediment control guidelines. Intrusive activity will not be conducted without prior approval of a site- or project-specific Construction Management Plan, which defines specific Best Management Practice (BMPs), environmental, and engineering control measures used to minimise impacts to surface water.

2.2.2.2 Constructional Equipment and Machinery

The constructional equipment and machinery that will be used will include:

- Dozers;
- Cranes;
- Loaders;
- Trucks;
- Concrete Mixers;
- Light vehicles;
- Excavators; and
- Delivery vehicles.

2.2.3 Operational Phase Activities

2.2.3.1 Erection of Structures

The proposed 10t/hr natural rubber processing plant to be constructed with associated warehouses are shown in **Figure 2.1**. The facility will have the following primary components:

- Reception area;
- Pretreatment line;

- Maturation area;
- Bleeding area;
- Wet line;
- Drying line;
- Packaging line;
- Loading bay and
- Warehouse.

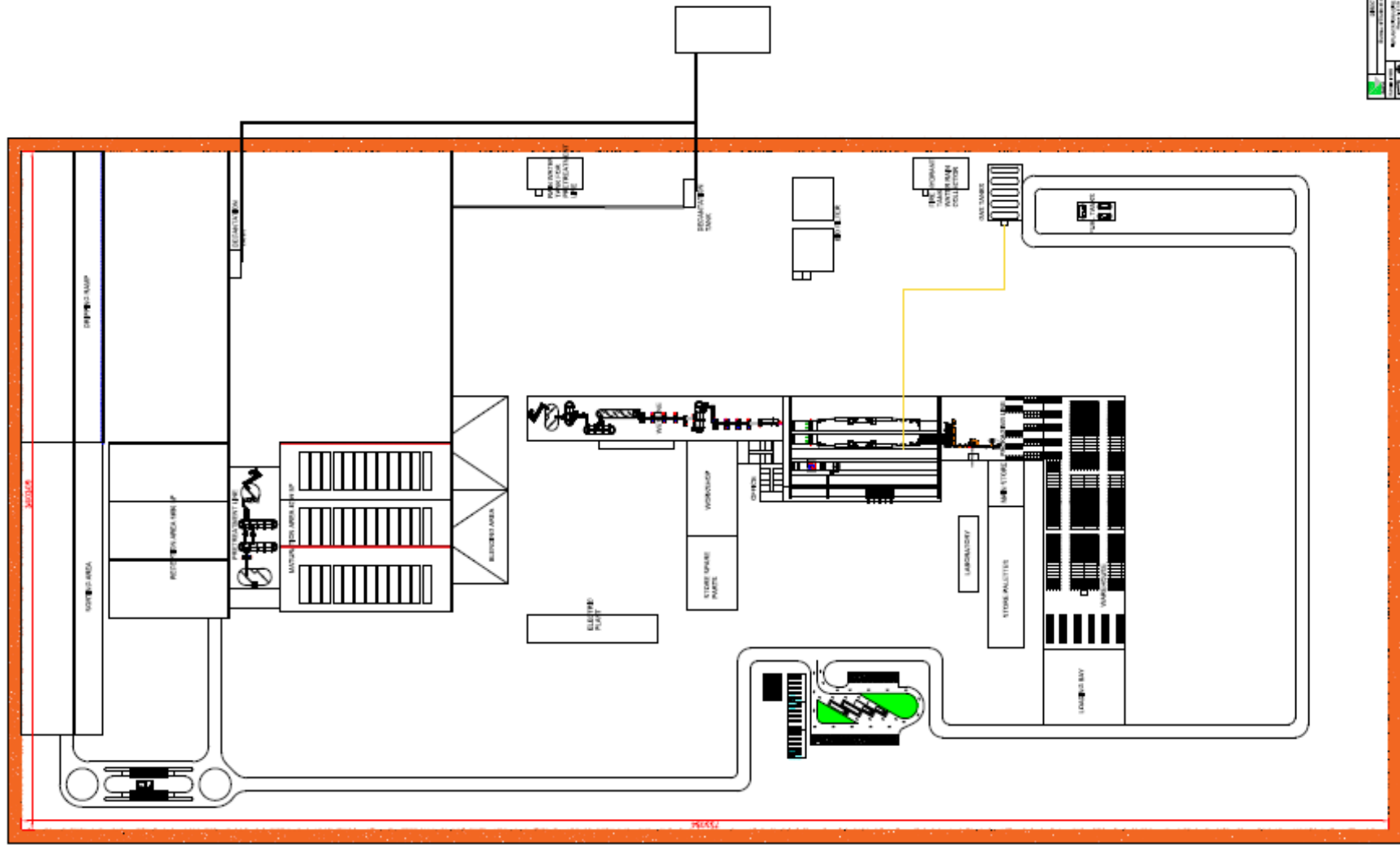


Figure 2. 1: Proposed Project Infrastructure Layout

2.2.3.2 Project Operational Components

The proposed natural rubber processing operations will have the following specific operational components:

- Raw material acquisition;
- Transportation of raw material to the plant site; and
- Rubber processing including product stocking and packing at the warehouse.

2.2.3.2.1 Raw Material

The primary raw material used in GREL production process is natural rubber. As indicated earlier, the natural rubber will be sourced from GREL's own 12,000 Ha plantation and from outgrower farms. Other secondary raw materials used in the production process includes reagents and chemicals, water, diesel and electricity.

Table 2.1 shows the proposed raw material type, sources and packaging form for the proposed project

Table 2. 1: Annual Raw Material Consumption

Raw Material	Source	Proposed Annual Quantity
Latex (kg)	Central Estates	23,200
Field Coagulated Rubber (t-wet)	Central Estates and Outgrowers	42,400
Electricity (mwh)	E.C.G. and Generating Set	8,300
LP Gas (t)	Oil Marketing Companies	230
Gas Oil (l)	Oil Marketing Companies	1,673,900

Composition of raw natural rubber (latex)

Latex is a dispersion of rubber in a watery serum containing various dissolved organic and mineral substances. The processing is to effectively do away with the non-rubber in the water dispersion.

Composition of Cuplumps is normally 55 – 65% Pure Rubber and 35 – 45% Water and Non Rubber components.

The following are the composition of the latex raw material:

- Water Content- 67%
- Pure Rubber -30%
- Non Rubber -3%

2.2.3.2.2 Production Process

The proposed production process of the 10t/hr plant is a mirror of the existing 10t/hr rubber processing plant. The process involves the preparation (removal of contaminants and blending to achieve homogeneity) of cuplumps, granulation, milling, drying and packaging.

i. Reception, Preparation and Storage of Raw Materials (Cuplumps)

- Plantation Cuplumps will be transported to the factory, weighed and discharged onto specified area of the 'Temporary Cuplumps Storage Area'
- Cuplumps from the Rubber Outgrowers farmers will similarly be transported to the factory, weighed and discharged onto the opposite side of the 'Temporary Cuplumps Storage Area'.
- There will be a laboratory analyzes of the raw Cuplumps to determine the blending ratio of CE to ROU. A laboratory engineer will give firm instructions on the blend to the Production Supervisors and the Bucket Loader Operators who are to effect the blending prior to processing.
- The Bucket Loader Operator acting on the instructions takes the prescribed number of buckets of Cuplumps from each origin and passes them through the Cuplumps Pre-treatment machines involving the JUMBO Slab Cutter and the Macerator installed together with bucket elevators and their accessories at one end of the temporary storage area to de-agglomerate the cuplumps and the release of the serum. The serum flows into some retention (sump) and through PVC pipe arrangement to join the process drain to the Rubber Trap before entering the treatment ponds.
- The Bucket Loader or Tractor Operator further transports the blended cuplumps for storage in the Cuplumps Cubicles before processing or to feed the Slab Cutter directly to begin the granulation (size reduction) processes. The Cuplumps in the storage cubicles are identified with date and Blend numbers as batches.

ii. Washing and Granulation

- Blended Cuplumps are fed into one of the two (2) Slab Cutters installed to separate any agglomerated lumps as well as starting incision or granulation.
- The lumps are transported from there to a 'Cleaning Tank' per Belt Conveyor from which Bucket Elevator carries them to an 8-shaped Blending Tank for washing and blending facilitated by the action of two (2) Stirrers installed on the tank.
- From Cleaning Tank #1, Bucket Elevator arrangement picks the lumps to one of the two (2) Wet Pre-breakers, the second size reduction machine, which reduces the lumps size to rectangular – liked shape of less than sixty (60) mm into a second cleaning tank with pipe network with water pump to facilitate washing, transportation and homogenization of the lumps.
- Bucket Elevator arrangement takes the lumps from this tank to T22 WPB, the third size reduction machine to cut the lumps to granules onto a belt conveyor to the first creper to start the blanket formation.

iii. Wet Processes

Seven (7) No 28" Creepers and two (2) Shredders installed and arranged in two (2) stages with metal conveyors between each two (2) creepers are used in the blanket formation process. The first stage consists of three (3) creepers and a shredder (intermediate shredder) and the second stage four (4) creepers and the final shredder. The system is such that depending on the quality of Cuplumps in process some of the creepers can be by- passed in the process. The blanket formation process is to expose the surface area for effective washing of serum and contaminants from the product.

The final shredder shreds the blankets into crumb sizes of 10 – 12mm and the crumbs pumped onto a vibrating screen for filling the drying pans. Lime solution is dosed into the shredder tank to prevent re-agglomeration of the crumbs to enhance the effective operation of the vortex pump in transporting the crumbs to the vibrating screen.

Solution of phosphoric acid is sprayed onto the rubber crumbs fed into the drying pans before the crumbs are dried. The phosphoric acid improves the quality (plasticity retention index) of the dried rubber.

iv. Drying

Two (2) dryers are installed and used. They are two (2) ton per hour Golsta Dryer (17 Trolleys) and 3 ton per hour Golsta Dryer (23 trolleys).

Each of the dryers has four (4) distinct zones separated by mechanical seals:

- Exhaust zone
- Drying zone
- Recycling zone
- Cooling Zone

Two (2) - 70m³ capacity Liquefied Petroleum Gas tanks installed (85% capacity is 34mt of LPG) to feed the dryers as alternative to the gas oil.

The dryers are pre- set automatically at the beginning of the drying. The parameters can however be adjusted in the course of the drying when necessary.

At the end of the pre-set time, a pusher mechanism at the exhaust end of the dryer starts running. The operator then pushes a fed trolley to the inlet of the dryer where the pusher mechanism draws the trolley in and ejects a trolley of dried rubber from the cooling end of the dryer. The temperature of the dried rubber (cake) on hearth must be less than 60°C.

v. The VKOR Project (Optional)

The VKOR project seeks to minimize waste and to optimize the cakes from the dryers in two ways:

- White spotted cakes which normally would have been reprocessed through the wet processes are rather reprocessed using the VKOR system. This prevent piled up white spotted cakes which are normally found in Rubber Processing factories during certain period of the year due to bad drying as well as change in the physiology of the raw rubber (Cuplumps).
- Drying rubber cakes could systematically be passed through the VKOR system to produce constant viscosity (CV) rubber with some doses of hydroxylamine sulphate solution.

The VKOR project consists of the following:

- 2No Dry Pre-breakers and electrical accessories.
- 5No Cooling Blowers and electrical accessories in series.
- Arrangement of belt conveyors.
- Weighing Scales.
- Baling Presses.

vi. Dry End Conditioning and Packaging

Packaging:

- 36 bales (1260 Kg) are put in a Shrink wrapping, on a wooden pallet or metal pallet.

Warehousing:

- 16 pallets (in Shrink wrapping) (20160 Kg) are put together at the warehouse.

The environmental process flow diagram is presented as **Figure 2.1**.

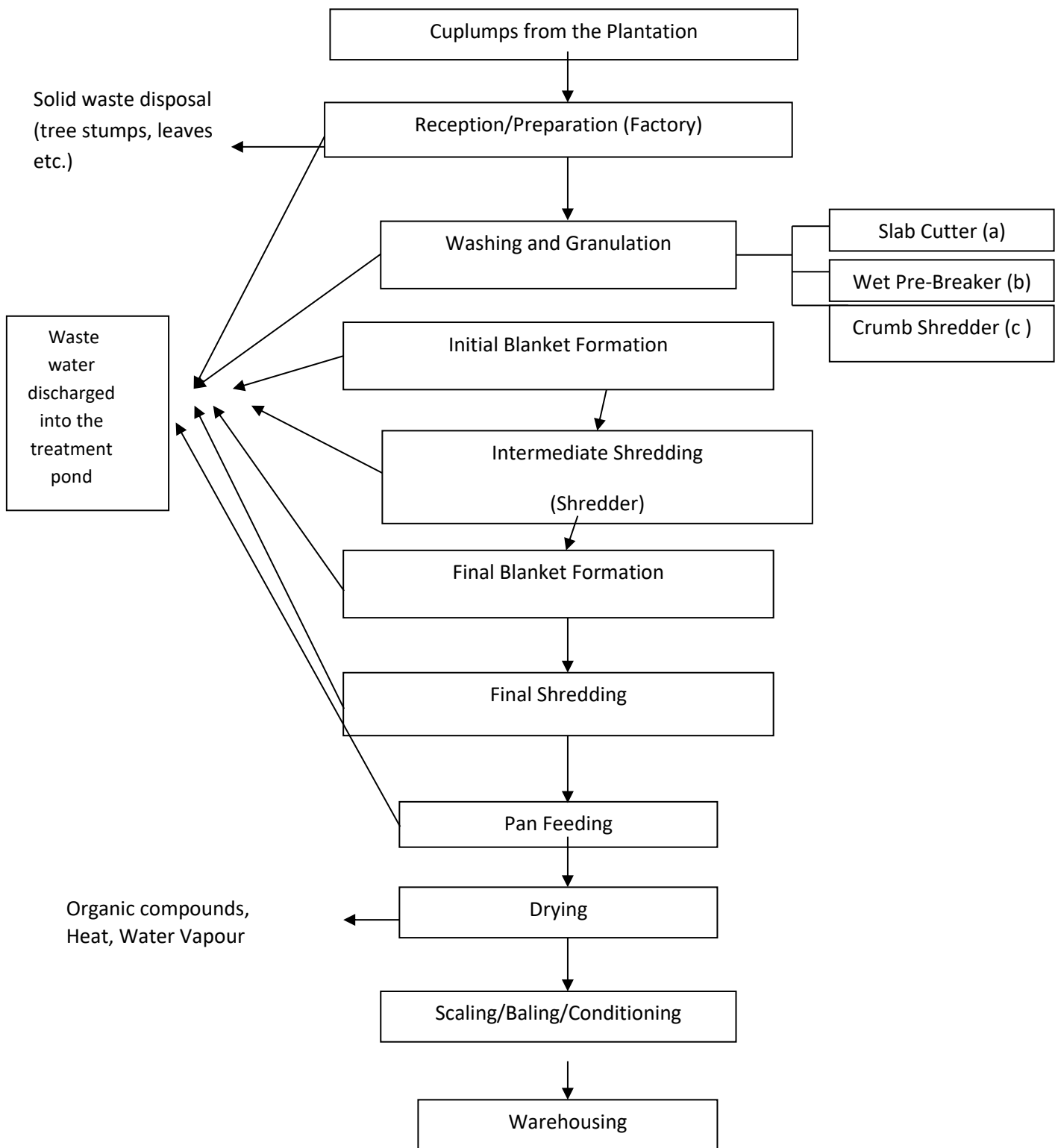


Figure 2. 2: Proposed Environmentally Flow Diagram

2.3 Operational Machinery

An inventory of machinery with specific design capacities from pre-treatment to cleaning, creping line, drying and baling have been presented as **Appendix 4**.

2.4 Source of Energy

The management of GREL will get its source of power from an existing transformer from the national grid (**Plate 2.1**) and a standby generator. The main power supply voltage level of the project will be 9,400 KW.



Plate 2. 1: Existing Transformer (arrowed) at the Abura Site

2.5 Water Supply

An existing dam constructed to serve the nursery of the company (**Plate 2.1**) will be extended to the project site.



Plate 2. 2: Existing dam at the Abura site

2.6 Labour Requirement

The Company currently offers employment to 560 salaried workers and wage employees with about 3000 dependants. In addition, 3,074 persons are also employed as contract workers.

- Management personnel – 102 including 4 expatriates
- Junior staff – 458

The factory as a department employs 116 permanent staff and 89 contract workers. The proposed processing plant will employ additional 100 (skilled and unskilled) workers.

3.0 BASELINE INFORMATION OF THE PROJECT LOCALITY

This section of the report outlines the status of the environmental resources prior to the commencement of the construction and operation of the proposed natural rubber processing facility. The level of impact would be better appreciated when the anticipated changes are compared against the already assessed and documented baseline conditions.

3.1 Project Location and Accessibility

The proposed new natural rubber processing plant will be located on a 123.5 acres at Abura, in the Ahanta West District of the Western Region of Ghana. The company's operational office is also located at Abura. The proposed Project will be located within GREL permitted boundary rubber plantation at the Abura operational site where field activities are controlled and monitored.

The proposed Project site is accessed from 40km from Takoradi along the Axim road (**Plate 3.1**). From the main gate of the Abura operational office, the site can be accessed at approximately 2km through the plantation roads (**Plate 3.2**).



Plate 3. 1: Abura Project site located along the Takoradi along the Axim road



Plate 3. 2: Access to the Proposed Project area through the Rubber Plantation within the Abura site

3.2 Existing Site Conditions

The proposed site for the natural rubber processing plant is within the 13,000 hectares of GREL rubber plantation. An area of approximately 123.5 acres of the over aged and under tapping rubber trees will be cleared for sitting the proposed processing plant. Plate 3.3 shows a section of the proposed project site.



Plate 3. 3: A section of the Proposed Project site showing Rubber Plantation

3.3 Land Use Zoning

The proposed project site is zoned as an agricultural and industrial area by the Physical Planning Department of the AWDA. The siting of the rubber processing plant within the rubber plantation will not in any way change the zoning status since activity conforms to the industrial and a zoned status. The site on which the project is to be located or sited has been earmarked for such establishments of the type to be engaged in, and conforms to environmental and industrial conditions and regulations.

3.4 Climatic Conditions

3.4.1 Rainfall

The project area is located within a sub-equator climate distinguished by a dry season from January to March and two rainy seasons (May – June and October) around a small dry season in August. The pluviometer varies from 1750 to 2000 mm per annum according to the regions. These climatic conditions are favourable for the cultivation of Hevea, the weakest pluviometries being compensated for by sufficient depth of the grounds.

3.4.2 Temperature and Wind Velocity

Temperature and relative humidity measurements obtained from the Meteorological Services Department indicate high values for both these aspects and persist for most times of the year. The highest mean temperature of about 31°C is measured in February and March and the lowest temperature of 25°C is normally recorded in August, which is the coolest month within the forest region of the country. The average annual temperature is about 22°C. The movements of two air masses namely, Southwest Monsoon and Northeast Trade winds determine the climate of Ghana.

These air masses get into contact with each other along the Inter-tropical Boundary. They have different air moisture and relative stability conditions and create four main climatic seasons for the country; two rainfall and two dry seasons. The average wind speed within inland areas which include a greater part of the humid forest zone encompassing the study area is generally below 8 km per hour. Such inland winds are relatively free from the influence of sea breezes but are affected by relief and by diurnal variations of heating and cooling. Wind speeds are lowest at night and during the early mornings. Wind speeds generally reach a maximum during the middle of the afternoon when average values of between 8 and 16 km per hour are experienced (Walker,

1962).

3.4.3 Relative Humidity and Evaporation

The relative humidity for the project area is highest (between 83% - 95%) early in the morning in May and June which coincides with the wet season. The relative humidity falls considerably during the main dry season and reaches a minimum during January and February.

3.5 Environmental Quality Monitoring

Aspects of the natural environment that could be impacted upon by the proposed project activities have been identified, and existing levels benchmarked to serve as reference points for future monitoring. The following are the measured parameters:

- Air quality and
- Noise levels.

The monitoring equipment and procedures used for the baseline survey are consistent with the methods approved by the Ghana EPA. The approach is also accepted internationally for conducting baseline surveys. Sampling for air quality and noise levels were conducted at the project site from the 19th to the 21st January 2018. All the monitoring equipment were calibrated before and after use as a requirement for ensuring integrity of the baseline results.

3.5.1 Air Quality

The air emissions to be emanated during operation of the rubber processing plant will be mostly hydrocarbons as a result of the rubber drying. The exhausts of the dryers will be joined a 'Gases wash and Bio-filter' facility. Smoke will also be given off from the exhausts of the fleet of vehicles and from the generating sets when they are used.

The proposed area is a greenfield located within the active GREL rubber plantation site with minimal disturbance. There are also no immediate settlement at the project area. The key air quality parameters are not expected to be above levels of environmental significance. The surveyed air quality parameters were:

- Dust Particles (Total Suspended Particles, PM₁₀) and
- Gaseous Emissions (NO₂, SO₂, HC, CO)

3.5.1.1 Dust Particulates (TSP and PM10)

Dust particulates comprise Total Suspended Particles (TSP) and particulate matter with diameter greater than 10 microns.

High Volume MiniVol Tactical Air Samplers (TAS®) were used for the measurement of the particulate matter (TSP and PM₁₀). The programmable sampling units were set over a 24-hour period at each sampling location to sample ambient air at a flow rate of 5L/min. Regular checks of the flow rate were conducted throughout the sampling period to ensure that constant flow rate was maintained. The sampling units were mounted at a height of about 2.0 meters above the ground level and away from any obstacle in order to prevent dust generation from gusting wind and restricted air flow. At each receptor location, both TSP and PM₁₀ was sampled at the same time for the same period.

Ambient air was collected over preconditioned (pre-weighed) non-fibre Whatman filter paper (Ø47mm) placed within a filter holder. A PM₁₀ impactor was fixed on top of the filter holder which ensures that only particles of size less than 10 micron reach the filter paper. In case of TSP sampling, the impactor was removed to allow total particulates in the air to reach the filter.

At the end of the sampling period, the filters were removed and kept in sealed filter holders to prevent moisture from reaching the filters. The filters were sent to the laboratory for re-weighing. The net weights were calculated and the dust concentrations were computed using the gravimetric method of determination of respirable and total inhalable particulate concentrations. The formula used to compute dust concentration is provided below.

$$\mu\text{g}/\text{m}^3 = \frac{\text{Net dust weight } \left(\frac{\mu\text{g}}{\text{m}^3}\right) \times 1000 \left(\frac{\text{L}}{\text{m}^3}\right)}{\text{Flow Rate } \left(\frac{\text{L}}{\text{min}}\right) \times \text{Sample time (min)}}$$

3.5.1.2 Gaseous Emission

Gases (NO₂, SO₂, HC and CO) were surveyed at representative locations along the 4 boundaries of the proposed project site to determine the existing concentrations. NO₂, SO₂, HC and CO gases were not detected per the detection limits of the equipment. The Ghana EPA recommended concentration guidelines are 60µg/m³ and 100µg/m³ for NO₂, and SO₂ respectively. The absence

of notable NO₂, SO₂, HC and CO emission sources could be responsible for the non-detection. Gases (NO₂, SO₂, HC and CO) were recorded for 24 hours at the various selected sampling locations within the project area. Two Sperian ToxiPro single gas detectors were mounted to detect the presence and levels of the gases.

The units were oriented against the direction of the wind. As the wind blow, air is absorbed onto a sensor and the gas is then detected and logged by the unit. The sulphur dioxide unit has a detection range of 0-100ppm with a resolution of 0.1 ppm whereas the nitrogen dioxide unit has a detection range of 0-20ppm with a resolution of 0.1 ppm.

Gas recordings were computed from the Sperian Toxi Pro and the Radiellos units by means of an infrared software device to obtain the relevant levels of nitrogen dioxide (NO₂) and sulphur dioxide (SO₂). **Table 3.1** presents the results.

Generally, the concentrations of the parameters monitored were all below the Ghana EPA Air quality guideline.

3.7.2 Noise Level

Noise levels were recorded at the entire project area, surrounding settlements and some link roads. The data was collected at 10 minute intervals from 08h00 to 17h30 for daytime. The results of the mean noise levels recorded at the project site and its environs are presented in **Table 3.2**

Cirrus sound level meters with CK:812B specifications were used for the noise level monitoring. Cirrus acoustic calibrator was used for the daily calibrations for accuracy. GPS readings (longitude, latitude) were taken at the monitoring locations at the project site.

From the results, the average daytime noise level as obtained at the project site is below the Ghana EPA guidance level for residential environments.

Table 3. 1: Summary of Air Quality Results over 24-Hour Period

Location ID	Dust Concentration ($\mu\text{g}/\text{m}^3$)		Gaseous Emissions ($\mu\text{g}/\text{m}^3$)				Weather Condition	
	PM10	TSP	NO2	SO2	HC	CO	Wind Speed	Wind Direction
North	25.6	45.4	ND	ND	ND	ND	3	SW
South	32.4	22.7	ND	ND	ND	ND	2	SW
East	15.9	36.8	ND	ND	ND	ND	2	VAR
West	38.7	25.6	ND	ND	ND	ND	2	S
EPA (Standard)	70	150	60	100				

ND: Not Detected; SW: South West; VAR: Variable

Table 3. 2: Summary Results of Noise Levels

Position	Position			Daytime Readings
	Leq	Lmax	Lmin	
Mid-Point	56.3	72.4	48.7	20-90
North	50.7	60.7	48.9	30-100
East	55.1	67.8	63.8	30-100
South	59.7	51.0	54.3	20-80
West	51.0	58.6	43.5	30-100

3.8 Geology and Soils

The geological process of Apimanim, Abura, Dixcove areas (GREL plantation) belong to the Precambrian basement with metamorphic, sedimentary and pyroclastic rocks of the upper Birimian and granitic intrusions of Dixcove type. This basement is covered with a layer of laterite, alluvial and colloidal deposits in the valley floors.

The topsoil consists of loose to medium reddish brown sandy silt. It is about 0.5m thick and consisted predominantly of silt and some sand and gravel and exhibited moderate plasticity.

3.9 Vegetation

The original vegetation cover of the area was tropical forest. Currently the concession is covered by rubber plantation. GREL rubber plantation cuts across Ahanta West, Nzema East, Tarkwa – Nsuaem and Prestea – Huni – Valley districts in the western region and Komenda – Edina – Eguafo – Abrem district in the central region. The Factory cover of 20 hectares includes offices, processing plant, treatment ponds, a Dam, Management bungalows, cuplumps reception and storage, weighbridge and ancillaries.

3.10 Topography

The main landscape varies from undulated to cut by valleys with vast plateau areas. The grounds are usually deep, clay-sandy to sand-clayey with at some places rocky levellings. The ground texture is totally favourable for the cultivation of Hevea (rubber tree) when there are no hydromorphic grounds or indurations (lateritic spots or gravel compact horizons) too near the surface.

3.11 Drainage

The major rivers in the area include: the Suoni River, Nyani River, Yeresuro River, Apusire River and Duobun River and the Tsibu stream. However, an existing dam that is fed by the Tsibu stream used for the purposes of rubber nursery irrigation will also serve as the source of water supply for the proposed processing plant. A water abstraction permit has been acquired from the Water Resources Commission (**Appendix 3**).

3.12 Socio-economic Environment

Abura falls within the jurisdiction of the Ahanta West District of the Western Region of Ghana. The District was carved out of the former Shama Ahanta East Metropolitan Assembly now Sekondi–Takoradi Metropolitan Assembly, in 1988 as per L.I.1395.

The District covers a land area of 591 square kilometers. It shares boundaries with Nzema East Municipal on the West, Tarkwa–Nsuaem Municipal and Mpohor Wassa–East to the north, and Sekondi–Takoradi Metropolitan Assembly to the East. It is boarded on the south by the Gulf of Guinea. The southern most part of Ghana lies in the district at Cape Three Points. The District is about 15 minutes' drive from the commercial capital of the Western Region, Takoradi and 25 minutes' drive from the administrative capital, Sekondi. In terms of distance, it is approximately 25 kilometers from the central business district of Takoradi. This proximity to the central business district of Takoradi enhances business and trade in particular.

Socio-demographic characteristics

The population of the District is 106, 215 according to the 2010 Population and Housing Census. This is made up of 50,999 males representing 48.01% and 55,216 females representing 51.99%. The Ahanta West District has a total land area of 591 square kilometers with a population density of 180.0 persons per square kilometer. This makes the District's population relatively dense. The population of the District constitutes about 4.5 % and 0.43 % of the total population of the Western Region and Ghana, respectively. The population of the district is relatively young, with over 47 % within the age group 0-17 years. The proportion of urban to total population is 29.5 %, with the remaining 70.5 %. The urban population covers peri-urban areas of Agona Ahanta, Apowa, Dixcove, and Abura. There are 26,095 households in the district, with the number of persons per household being approximately 4.1 as compared to both the regional and national average of 4.2 and 4.4, respectively.

Settlement

The District is predominantly rural and has over 123 settlements, with Agona Nkwanta as the district capital. It also doubles as a constituency and has six (6) Area Councils namely; Agona, Busua,

Apowa, Abura, Dixcove and Ewusiejoe and 36 Unit Committees. The District is quite homogeneous in terms of ethnic classification with Ahanta as the dominant group. Other major ethnic groupings are Fanti, Nzema, Wassa and Ewe. There are three paramountcies, namely; Busua, Upper Dixcove and Lower Dixcove with the Omanhene at Busua.

Economic Characteristics

The District is endowed with considerable natural resources, which gives it a significant economic importance within the context of national development. It is one of the largest producers of rubber and oil palm in the region. A wide variety of minerals, including oil, gold and quarry stones are either being exploited or are potentially exploitable. The District's total mineral potentials are yet to be fully exploited.

Agriculture is the major economic activity undertaken in the district. It is estimated that about 65% of the active population is directly involved in agricultural production. Other economic activities include trading (commerce) and processing of agricultural produce, mainly palm oil, cassava and rubber. Others are mainly artisans and self-employed. The District's main market is among the seven biggest markets in the country.

Financial Institutions

There are two banks; namely the Agricultural Development Bank Limited at Agona Nkwanta and Zenith Bank Ghana Limited at Abura. In addition, there is one rural bank; the Ahantaman Rural Bank with its headquarters at Agona Nkwanta. It also has two agencies in Apowa and Abura. There are six Micro Finance Institutions in the district namely: GESRO Cooperative Credit Union, Royal Winners Micro Finance, GHAMFO, SkyLimit MicroFinance, Tandoh Micro Finance and Aped.

Infrastructure

The number of health facilities in the district has seen a slight increase over the last three years. After remaining constant during 2009 and 2010, two (2) additional CHPS compounds have been established, bringing the total number of health facilities in the district to 18 in 2012. The district has one (1) public hospital located at Dixcove, four (4) health centres, three (3) clinics and 10 CHPS compounds. There are also 95 outreach points and a number of drug

stores that are highly patronized by members of the community. The proximity of the district to Takoradi enables many inhabitants, particularly those living in Apowa, New Amanful and Funkoe, to patronize health facilities in the Sekondi-Takoradi metropolis.

Education

One of the fundamental inputs towards the realization of the MDG for education is children's access to education which depends largely on the number of schools available. The Ahanta West District has a number of basic and second-cycle institutions. Currently, there are 97 Kindergartens, 87 Primary schools and 60 junior high schools. The District also has two senior high schools and one technical/ vocational institute.

Health

The goal of the district is to improve access to quality maternal, child and adolescent health services; intensify prevention and control of non- communicable and communicable diseases among others. It also seeks to reduce maternal and child mortality rates, combat HIV and AIDS and other diseases.

The district has two (2) doctors and 110 nurses, which results in a high patient/ doctor ratio. The problem confronting the health sector is not only inadequate health facilities, but also inadequate personnel who are reluctant to accept postings to remote areas without facilities, medicines and medical equipment.

HIV & AIDS

Data on HIV and AIDS in the District is scanty and difficult to obtain. Nonetheless, available data gathered from the District Health Directorate on the "Know your HIV Status" campaign, which was carried out in 2010 in seven (7) communities had 68 out of 1,500 people testing positive.

Records on PMTCT are accurate and up-to-date due to the compulsory counselling and testing of all pregnant women who attend antenatal.

Major issues Facing Frets

As part of the consultation process, officials of the Ahanta West District Assembly were met to discuss the project. The socio-economic team also made several visits to the proposed project area to undertake stakeholder assessment. The team conducted a baseline survey through focus group discussions and key informants interviews with community chiefs and elders, women, youth, farmers, Assembly member, unit committee members and other opinion leaders to present their perceptions and expectations of the project.

Key development issues facing Abura

Based on the focus group discussions with representatives from the chief and elders, women, farmers and youth the following key issues affecting the communities were identified. The following are the developmental issues facing Abura:

Poverty and unemployment: Unemployment and the lack of job opportunities for majority of the young men and women in the village is a major problem. It has created financial problems for a large number of households in the village which often impact on the ability of parents to send and keep their children in school, especially the older children who are forced to leave school and find work to supplement the household income.

Inadequate water supply: Out of the two boreholes in the village, only one is working. One is polluted whilst the other is broken down. Even though all the water sources are reliable, only one is of good quality. This supply option does not meet the needs of the village.

Lack of reliable public transport: The mobility of the members of the community and their ability to access markets and key services is further compounded by the lack of a reliable public transport service;

Lack of recreational facilities: lack of football field in the community restricts the recreational avenues of the youth in the village.

4.0 IMPACT IDENTIFICATION AND ASSESSMENT

The objective of this section is to identify and assess the potential impacts associated with the proposed natural rubber processing plant. The assessment will look at the net changes in key environmental and socio-economic issues on the proposed project.

4.1 Method of Identification of Impacts

This section outlines the methodology used to assess impacts associated with the proposed project. The methodology used to assess and evaluate the potential impacts and to predict their significance was based largely on the prognosis of professional experts who have worked on similar projects and also experiences of the various specialists who conducted the baseline surveys.

Impact significance was rated according to their Direction, Magnitude, Duration, Extent and Probability of occurrence. These terms are briefly described below.

Direction of an impact may be positive, neutral or negative with respect to the particular impact.

Magnitude is a measure of the degree of change in a measurement or analysis (e.g., the area of pasture, or the concentration of a metal in water compared to the water quality guideline value for the metal), and is classified as none/negligible, low, moderate or high. The categorization of the impact magnitude may be based on a set of criteria (e.g. health risk levels, and/or professional judgment) pertinent to each of the discipline areas and key questions analysed. The specialist study must attempt to quantify the magnitude and outline the rationale used. Appropriate, widely-recognised standards are used as a measure of the level of impact.

Duration refers to the length of time over which an environmental impact may occur: i.e. transient (less than 1 year), short-term (0 to 5 years), medium term (5 to 15 years), long-term (greater than 15 years with impact ceasing after closure of the project) or permanent.

Scale/Geographic extent refers to the area that could be affected by the impact and is classified as site, local, regional, national, or international.

Probability of occurrence is a description of the probability of the impact actually occurring as improbable (less than 5% chance), low probability (5% to 40% chance), medium probability (40 % to 60 % chance), highly probable (most likely, 60% to 90% chance) or definite (impact will definitely occur).

Impact significance was rated by the specialists using the scoring system shown in **Table 4.1**

Table 4. 1: Scoring system for evaluating impacts for proposed development

Magnitude	Duration	Scale	Probability
10 – Very high	5- Permanent	5- International	5-Definite/Don't Know
8 – High	4- Long Term (Impact ceases after closure)	4- National	4- Highly probable
6- Moderate	3- Medium-term (5-15 years)	3- Regional	3-Medium Probability
4- Low	2-Short-term (0-5 years)	2-Local	2-Low Probability
2-Minor	Transient	1-site only	Improbable
1-None			0 - None

After ranking these factors for each impact, the significance of the two aspects, occurrence and severity, was assessed using the following formula:

$$\text{SP (significance points)} = (\text{magnitude} + \text{duration} + \text{scale}) \times \text{probability}$$

The maximum value is 100 significance points (SP). The potential environmental impacts were then rated as of **high** (SP > 75), **moderate** (SP 30 – 75), or **low** (SP < 30) significance; with and without mitigation measures on the following basis outlined below in **Table 4.2**

Table 4. 2: Significance Scale

SP >75	Indicates high environmental significance	Where it would influence the decision regardless of any possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.
SP 30 - 75	Indicates moderate environmental significance	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged.
SP <30	Indicates low environmental significance	Where it will not have an influence on the decision. Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation.
+	Positive impact	An impact that is likely to result in positive consequences / effects.

4.1.1 Pre-Constructional Phase Impacts

The activities involved this phase of the project includes:

- Project planning and design
- Project site inspection;
- Surveying and demarcation by a surveyor;
- Registration and initiation of permitting process at EPA to guide the impact assessment study by screening the initial application and advising on the preparation of the environmental impact assessment.
- Stakeholder consultation;
- Environmental and socio-economic baseline surveys; and
- Environmental impact assessment.

These activities will have negligible impacts on the environment and therefore required no mitigation measures.

4.1.2 Constructional Phase Impacts

This constructional phase of the project will involve site preparation for construction, haulage to site of construction equipment and materials, some excavation works, the actual construction works, landscaping and removal of residual constructional materials and equipment. The following impacts are likely to be emerged:

- Loss of vegetation cover (Change of landscape from the massive cutting of the rubber plantations)
- Dust Emission
- Noise Generation
- Waste Generation
- Occupational safety and health hazards
- Socioeconomic benefits from employment generation and its multiplier effect for the people of the project area as well as from the Ahanta West District of the Western Region.

4.1.3 Operational Phase Impacts

The impact to be associated with the project operational phase includes:

- Generation of high level of odour
- Generation of effluent
- Generation of solid wastes
- Waste oil and chemicals contamination
- Noise generation at the milling, drying sections, diesel generators
- Increased risk of fire
- Occupational health and safety concerns and
- Increased concentration of gaseous emissions from equipment exhaust, additional generators, and rubber processing plant.

4.1.4 Closure Phase

The closure phase is defined as all activities following the closure of the natural rubber processing operations. Impacts associated with closure are related to the long term stability of the site. Closure

impacts may result from a poor understanding of the site or as a result of poor management during the development and operational phases. GREL is committed to and will make every effort to address all potential long term issues during the project operation phase.

4.2 Evaluation of Impacts

4.2.1 Construction Phase

4.2.1.1 Loss of Vegetation

As indicated in the baseline section of this report, the original vegetation cover of the project area was a tropical forest but is currently covered with GREL rubber plantation. Preparation of the project site would result in the clearing of the rubber plantation at the proposed facility area. The result is that GREL would lose some commercial value to the rubber plantation. This impact will therefore have a *low environmental* significance.

4.2.1.2 Dust Emissions

Land clearing activities, movement of trucks and heavy-duty equipment to and from the project area, as well as construction work and stockpiling of earth materials, will contribute to dust emissions. The amount of dust generated from these activities can vary significantly depending on the area to be cleared and the construction season. As a common practice outdoor construction works are carried out during the dry season. At this time of the year natural atmospheric dust concentrations can be at their maximum.

During the actual constructional phase, materials to be used include portland cement, sand, iron rods, wood and gravel. Cement for instance can easily be blown away as dust particles into the ambient air. Though the activities mentioned above were likely to increase the concentration of particulates, they were not expected to travel more than 80m from the sources. Fortunately, there is no settlement in the immediate (2km radius) from the project site.

Emissions from the constructional activities will be short lived and largely restricted to the construction site. This impact will therefore have a *moderate environmental* significance before mitigation. With mitigation, these impacts were reduced to a *low* environmental significance.

4.2.1.3 Noise Generation

The use of heavy equipment during site preparation, transportation of equipment and machinery and the actual construction generated excessive noise. Also, constructional activities involving fabrications and welding generated excessive noise. Site workers and machine operators are particularly vulnerable to the risk of the noise generation.

The probability of occurrence of the impact was considered to be medium. The overall impact was for a short duration of the constructional phase and the scale of the impact was localised. The environmental impact significance has therefore been assessed to be *moderate* but was reduced to a *low* significance following mitigation

4.2.1.4 General Waste Generation

Waste to be generated during the constructional phase of the project include domestic waste, plastics, excavated soils, and packaging materials and discarded building materials like broken cement blocks and pieces of wood. These wastes if not disposed properly could obstruct the free movement of workers and trucks. The presence of the wastes could also adversely affect the aesthetics of the site and depending on the waste types, could impact on the health and welfare of the workers. This impact was therefore assigned a moderate *environmental* significance before mitigation. With mitigation, these impacts were reduced to a *low* environmental significance.

4.2.1.5 Occupational Health and Safety Concerns

Occupational safety, health and welfare issues was identified and discussed under this section. These issues arise as a result of the properties of the raw materials and the inherent dangers in the design and use of machinery. It is important to institute safety, health and welfare measures to mitigate the hazards and prevent accidents during the constructional phase of the undertaking. Issues of importance include:

Excessive Dust Inhalation

The nature of some of the building materials and the exposure of soil surface may generate dusty conditions at the work site. This may in turn bring about the excessive inhalation of fractions of dust and other airborne particulates. Site workers will have to be protected against this potential

impact.

Accidental Falls

It was expected that at certain stages during the construction, workers will be working at heights above 2.4 metres. This could result in accidental falls that could lead to injuries and jeopardise the safety and health of workers. This is obviously a workplace hazard that must be guarded against. Mitigation measures are proposed for this potential impact.

Potential Collapse of Scaffolding

On any construction site, the possibility of collapse of weak and inadequately constructed scaffolding is a very real hazard. Apart from this potential collapse, objects on the scaffolding, such as tools, head pans or parts of the scaffolding may fall onto other workers or authorized visitors to the sites. Adequate measures must be introduced to reduce this potential danger.

Potentially Hazardous Machinery

Hazards associated with unsafe machinery include failure of lifting devices (such as cranes) and unfired pressure vessels. Electrical appliances with the insulation on their cables destroyed also fall under this category. These hazards are likely to cause accidents and injury to both workers and visitors to the construction site. Mitigation measures will be proposed to manage this potential impact.

Public Safety

All the above-mentioned hazards apply almost equally to visitors to the site who may not be sufficiently well informed about the activities and hazards at the proposed construction site. Measures will be taken to safeguard the safety of the public especially from falling objects and from falling into unprotected pits or depressions.

This impact has a ***moderate environmental*** significance before mitigation. With mitigation, these impacts were reduced to a ***low*** environmental significance.

4.2.1.6 Employment and Income Generation

Creation of new jobs for people and the associated income and taxes generated by the project is certain for both phases of the project. As an example, the number of construction workers required for the project could be about 50 (to be determined by contractor(s)). The construction and operational phases will require the employment of some skilled, semi-skilled and some level of unskilled labour for the civil, mechanical and electrical works including operators of equipment and machinery at the project site. Indirect impacts are those impacts that would occur as a result of the new economic development and would include things such as new jobs for businesses that support the expanded workforce or that provide project materials, and associated income and taxes. These sources of impact are considered slightly beneficial but of short duration. Opportunities will be explored to enhance the effect of these impacts to the local people.

This impact has a **positive environmental** significance.

4.2.2 Operational Phase Impacts

4.2.2.1 Generation of High Level of Odour

The processing of natural rubber is characteristically odorous. Natural rubber has high concentration of protein and carbohydrates and therefore promotes the growth of bacteria. This bacteriological growth destroys the antioxidant (in the form of naturally occurring proteins and amino acids) inherent in the latex and causes the release of Cu^{2+} which further promotes oxidation. The increased bacteriological activity produces the odour generated by the protein biodegradation into ammonia compounds and sulphides. These odours are present during:

- Storage of Cuplumps and
- Drying phase of the production process

This impact has a **high environmental** significance before mitigation. With mitigation, these impacts were reduced to a **moderate** environmental significance.

4.2.2.2 Generation of Wastewater

Wastewater discharged from latex rubber processing usually contains high level of BOD, COD and suspended solids. These characteristics could vary as a result of the difference in raw latex and

applied technique in the process. The main source of the pollutants is the coagulation serum, field latex coagulation, and skim latex coagulation. These compounds are readily biodegradable and this will result in high oxygen consumption upon discharge of wastewater in receiving surface water.

These liquid waste impacts have a **High** environmental significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

4.2.2.3 Generation of Solid Waste

Solid wastes will emanate from both production floor and the administrative section. Solid wastes to be generated during the project operations include scrap iron sheets, cuttings, trimmings, plastic bags, chemical containers etc. Some empty metal containers are reused after thorough cleaning; metal scraps are packed and sold to dealers upon request.

These solid waste impacts have a **High** environmental significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

4.2.2.4 Waste Oil Contamination

Accidental spills of petroleum products are associated with the rubber processing operations.

Waste oils will be generated from the following activities:

- Servicing of processing machines at the factory
- Servicing of handling equipment – forklift, bucket loaders at the factory
- Servicing of factory pick up
- Servicing of trucks transporting cuplumps (raw material) at Abura Garage.
- Servicing of heavy duty equipment at the Garage.

This impact has a **High environmental** significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

4.2.2.5 Noise

Noise will be generated during the project operational phase from the production floor and that includes; maintenance, and workshop, wet and dry sections as well as the raw material reception.

Noise that will be generated from these areas will cause a significant impact on workers. Noise will also reduce the labour productivity and will cause lack of attention which will lead to accidents.

This impact has a **High** environmental significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

4.2.2.6 Potential Fire Outbreak

The use of fire on any premises obviously increases the potential for fire outbreaks. In GREL, the use of the dryers and liquefied Petroleum Gas storage Facility are therefore a direct source of any potential fire outbreak. Naked flames are also used for welding operation.

Fire outbreak is accompanied by the emission of soot and smoke. The fumes, if not controlled are likely to introduce environmental hazards in the factory and the outlying residents further east of the premises.

This impact has a **High** environmental significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

4.2.2.7 Occupational, Health and Safety Concerns

Due to the concentration of people and equipment in the operational phase the potential causes of ailments and accidents could be high, thus consideration would be given to the protection of employees, customers and visitors. Improper handling of raw materials and products, equipment and products of any form by workers may lead to some injuries and even fatalities in certain cases. Workers involved in the loading and unloading of products unto trucks may be injured if caution is not taken. Workers at the processing plant will be exposed to potential hazards inherent in the job, material handling and work environment. Injuries from unguarded machinery, electrical shocks, slips, wet/slippery floors, hearing impairment from excessive noise from pumps, compressors etc. are

common with this particular industry type. Workers would be exposed to potential occupational hazards particularly:

- Improper operations or handling of equipment and tools such as to discharge waste leading to accidents;
- Loading and unloading of products and raw materials into delivery/supply vehicles as well as traffic safety;
- Slippery floors at the processing section; and
- Accidents from moving unguarded machinery and electrical shocks.

The lack of sufficient health and safety facilities may increase risks from such impacts and health and safety issues are ranked as having **moderate** significance. With sufficient mitigation and monitoring this impact can be reduced to one of **low** significance.

4.2.2.8 Socio-economic Issues

The proposed location of the project could cause other impacts and also raise positive concerns from other land users in the neighbourhood. These may include socio-economic impacts relating to employment generation and tax revenue. The potential for job creation from the project is high. However, the project will provide both direct and indirect jobs at various stages of its operations. At the construction stage, over 50 jobs would be provided for both skilled and unskilled labour force including engineers, masons, carpenters, labourers, etc. This may be temporal. Again at the operational stage the project will provide permanent job opportunities for additional 50 professionals and non-professionals. Additionally, the project will provide many more indirect jobs for vessel/transport owners/companies, waste recyclers and food vendors at the project site. The project will also bring in its wake the payment of corporate taxes to government.

Given the high demand for employment and population size, in the project area, this impact will have a **High positive** environmental significance, and will remain of **High positive** significance after mitigation measures are implemented.

4.2.2.9 Gaseous Emissions

Air emissions that will emanates from the premises of the factory are mostly hydrocarbons given off as a result of drying the rubber. The exhausts of the dryers are joined to the 'Gases wash and Bio-filter' facility. Smoke is also given off from the exhausts of the fleet of vehicles and from the generating sets when they are used when the national grid went off.

This impact has a **High** environmental significance before mitigation. While the implementation of mitigation measures is likely to reduce the magnitude and scale of the impact, the environmental significance is anticipated to remain **moderate**.

5.0 MITIGATION MEASURES

One of the main aims of the environmental impact assessment (EIA) process is the mitigation of negative environmental impacts (Wood, 2003). This chapter presents the mitigation measures envisaged to minimize, control and if possibly eliminate adverse effects/impacts associated with the construction, operation and decommission phases of the project. The impacts, which have been identified and discussed in Chapter 4, are classified as typical of rubber processing plant projects.

5.1 Constructional Phase

The following mitigation measures will be implemented during the constructional phase of the natural rubber processing facility.

5.1.1 Management of Vegetation Clearance

The original vegetation cover of the project area was a tropical forest but is already severely degraded due largely to agricultural (i.e GREL rubber plantation). Therefore, the construction of the facility at the proposed project site will not have significant impact on the flora of the area.

GREL will put in place measures to protect the existing limited vegetation presently at the project site. Only those areas required for the proposed facility will be cleared of vegetation.

5.1.2 Dust Control

Stockpiled construction materials in loose bulk (e.g. sand, laterite) will be covered with tarpaulin to prevent wind generated dust. Again, dust will be suppressed by watering with a water bowser as and when necessary. Appropriate personal protective equipment will be provided for all construction workers and measures put in place to ensure that they are used effectively.

A monitoring program for dust will be extended to the proposed project area to assess the effectiveness of control measures in meeting ambient air quality standards.

5.1.3 Noise

Employees working in areas with high noise levels will be provided with ear muffers. All workers engaged in all phases of the project will be supplied with ear muffs to protect them against the general high noise levels in the plant.

The following noise mitigation measures will be strictly adhered to during the project construction:

- Restricting the noisiest activities to the daytime period, when ambient noise levels and the Ghanaian EPA noise limits are higher;
- Provision of ear plugs to workers working in noise prone areas;
- All construction machinery or equipment was maintained on regular basis, paying particular attention to all noise muffers to ensure that they are in good working condition to minimize noise generation.

5.1.4 General Waste Management

Workers will be trained on good housekeeping. All construction waste will be collected and disposed of in a designated containers or bins to prevent polluting the environment as per GREL waste management plan. Metal cuttings will be cleaned up and stored in bins and later transferred to designated disposal points.

5.1.5 Occupational Health and Safety Concerns

Health and Welfare

Hard hats and safety boots will be provided to all workers at the proposed construction site for protection against falling objects. First aid facilities will be made available on the site in accordance with the Factories, Offices and Shops Act, 1970. Minor injuries will be attended to at GREL clinic on site. More serious injuries that cannot be adequately treated at the site will be referred to the Effia-Nkwanta General Hospital.

The use of personal protective equipment such as gloves, safety boots, hard hats, earmuffs and nose masks are very important for the construction workers and authorized visitors. Workers will be supplied with protective clothing to protect them from potential injuries and hazards to their health.

It will be mandated for all employees and visitors to use the appropriate Personal Protection Equipment (PPEs). Employees who refused to use the protective equipment were sanctioned. All damaged and defective personal protective equipment will be promptly replaced.

Potential Collapse of Scaffolding

The scaffolding used during the construction was made from sturdy and strong material, mostly metal. Management will ensure the use of such strong scaffolding by the contractor(s). Employees who work at heights where the use of scaffolding were not used were provided with helmets.

Machine Safety

All potentially hazardous machinery such as lifting appliances (cranes, etc.) and unfired pressure vessels (compressors, etc.) will undergo statutory examination by a certified engineer. This will ensure that accidents due to equipment failure are prevented. All electrical cables of mobile or hand-held machines (electric hand drills, temporary lights) will be examined for flaws in insulation and when detected will be replaced.

Public Safety

All unauthorized persons will be kept off the construction site. The whole project site will be fenced and cautionary notices like “No Thoroughfare” “Out of Bounds” “No Entry” visibly displayed at the gates and on the fence to ward off the public from the project site.

All visitors who visit the site will be adequately protected by the provision of safety helmets and safety boots and will be kept away from hazardous machinery or areas. These measures will minimize the potential dangers to public safety.

5.2 Operational Phase

5.2.1 Odour Management

The proposed 10t/hr processing plant site has no immediate settlement (2km radius). Again the odour to be emitted from the rubber processing plant is a nuisance but has no health hazard, according to medical experts.

An odour survey conducted at the existing GREL Apimanim 10t/hr rubber processing plant identified two main areas as sources of odour:

- Cuplumps (Raw material) Storage Area
- Dryer Exhausts

The proposed 10t/hr rubber processing plant will implement the following measures to minimize the emanation of odour;

Measures to Reduce Odour at Cuplumps Storage Area.

1. The construction of 'Temporary cuplumps storage'.
2. Storage of pre-treated cuplumps in the high capacity Cuplumps storage cubicles
3. Continuous housekeeping at the pre-treatment section to prevent serum fermentation.
4. The cuplumps pre-treatment processes involving the installation of JUMBO slab cutter, Macerator and their accessories to facilitate cleaning and squeezing out of serum from the cuplumps before storage. This will be done by the procedure described below:

The floor of the storage area will be concreted and adequate slopes will be provided to prevent accumulation and subsequent stagnation of serum from the Cuplumps, thereby minimizing the fermentation process.

Another two 25m pressurized water hoses will be permanently fixed at the storage area and two workers (cuplumps cutters) will be charged with the responsibility of using the hoses to wash and direct the serum through the drains in order to avoid stagnation and subsequent fermentation.

Measures to Reduce Odour in the Dryer Exhausts

An incorporation of a 'Gases wash and Bio-filter facility' in the proposed facility will help mitigate the odour from the dryer exhausts. This will be an improved version of the existing facility used at the Apimanim site. Two air scrubbers will be installed on two different dryers. The scrubbers are made up of packed materials (plastic balls) meant to reduce the odour and clean the exhaust byproducts (water vapour) from the dryers. Water circulation system in the

installation will condense about 60% of the vapour back to water whilst the remaining 40% goes into the atmosphere. The condensed vapour will then be channeled through a drain to the rubber trap.

The company will also put in place a system to change the wooden chips in the bio-filter every year to improve its operational efficiency.

5.2.2 Wastewater Management

The wastewater to be generated from the factory will be treated and recycled for re-use in the factory. Wastewater from the will be designed to pass through drains with adequate slopes via rubber trap and eventually flows by gravity into treatment ponds. An estimated 230,000m³ of effluent will be generated per year.

The wastewater will be treated by passing it is through a prolonged passage through a series of connected ponds that will contain high concentrations of naturally occurring bacteria. These consume biodegradable matter, which treat the effluent. Functionally, the pond system will be divided into three sections, namely:

- Rubber trap;
- Anaerobic; and
- Aerobic.

Rubber trap

Effluent from the Factory will be channeled through a Rubber trap system where solid wastes in the form of rubber crumbs that escaped the interceptors at the factory floor will be trapped. The crumbs trapped will then be collected at 12 hours interval into cleaning tanks at the Factory. The rubber crumbs will then be washed and re-milled through the cuplump production line.

Anaerobic Pond

The anaerobic environment produced in the first pond will aid in the growth of acid forming and methanogenic bacteria. The acid forming bacteria will consume the organic waste material thereby producing short chain fatty acids such as acetic acid. The methanogenic bacteria will then consume

the fatty acids and break them down to carbon dioxide and methane. These gases will bubble out of the pond.

The treatment performance of the anaerobic pond will be enhanced by the pond geometry that will promote rapid mixing with digesting sludge (where bacteria are concentrated). Settleable matter from the influent is deposited and further removal of organic matter occurs by anaerobic microbial activity. Settleable solids will also assist in the reduction of nitrogenous load from the pond.

The suspended solids and BOD reduction will occur mainly in the anaerobic section of the ponds. Heavy metal removal will be done by precipitation as sulphides in the anaerobic pond.

The two anaerobic ponds together will have a total retention period of approximately eight (8) days.

During the retention period, the anaerobic bacteria at the bottom and the microaerophilic and microflora at the surface will facilitate the treatment processes. Carbon dioxide produced by the anaerobic bacteria at the bottom will be used by the autotrophic bacteria and algae at the surface. Autotrophic bacteria including sulphur bacteria will form a large proportion of the photosynthetic biomass in the pond.

The Anaerobic pond effluent will be low in Biological Oxygen Demand (BOD), low in Dissolved Oxygen (DO) and low in algal population. Nitrogen will be found mostly in organic and ammoniacal forms. Reduction in ammonia concentration will take place through natural sedimentation of organic material such as plankton.

Minimal level of odour associated with the treatment system will come from:

- Decomposition of organic matter, mainly rubber crumbs, which escaped the interceptors and flow along the trap and the anaerobic ponds to become part of the scum covering on the ponds. This normally happened during week – end cleaning when workers rush to open the drain valves of the process tanks to facilitate early cleaning. The control measures include procedure for systematic opening of the drain valves and frequent removal of such crumbs from the surface of the dam.

- The evolving methane gas associated with anaerobic ponds. It is a potential Cleaner Development Mechanism (CDM) project which management could consider in the future.
- The continuous working of the aerators in the aerobic pond suppresses any scent from the water.

Aerobic Pond

This section functions mainly as polishing pond. In this pond, there will be a quick succession of micro-organisms. As the treatment progresses, more species are colonized resulting in a more diverse community. With increase in photosynthesis, there will be an increase in dissolved oxygen. In the presence of oxygen, and as the conditions become favourable, nitrifying bacteria oxidize ammonia to nitrite and nitrate. As the concentration of ammonia is reduced, its toxicity to biota is also reduced, allowing more organisms to inhabit the pond. Species diversity is inversely proportional to BOD and Ammonia concentration.

Aerated Pond

Modern lagoon systems utilize mechanical surface aerators to suppress odours from the initial ponds. GREL will install a number of aerators of 2.2 Kilowatt capacity to enhance the treatment process by accelerating the reduction of organic matter.

The performance of the ponds will be dependent on temperature and retention period. For the aerobic pond, the retention period is approximately ten (10) days.

The treated effluent will be directed into a “fish” pond where it will either be pumped into a 400m³ concrete water tank or into the dam reservoir. Water from the reservoir is used in watering the rubber nursery.

Table 5.1 shows the proposed design performance of the waste treatment facility.

Table 5. 1: GREL design basis and expected treatment performance

Parameters	Units	Concentration /Value	Load (kg) / flow	Treated Values for recycling	EPA Thresholds
Daily flow	m ³ /d		3.000		
Peak flow	m ³ /h		375		
pH	s.u.	6 - 8	-	6-9	6-9
BOD	mg/l	800	2.400	50	50
COD	mg/l	1.600	4.800	100	250
BOD/COD	-	0,50	-	0,50	
TSS	mg/l	350	1.050	50	50
TDS	mg/l	800	-	1.000	1000
Total N	mg/l	120	360	-	-
BOD : N	100 :	15	-	-	-
Total P	mg/l	56	168	10	

Wastewater Treatment Flow Chart is illustrated in Figure 5.1.

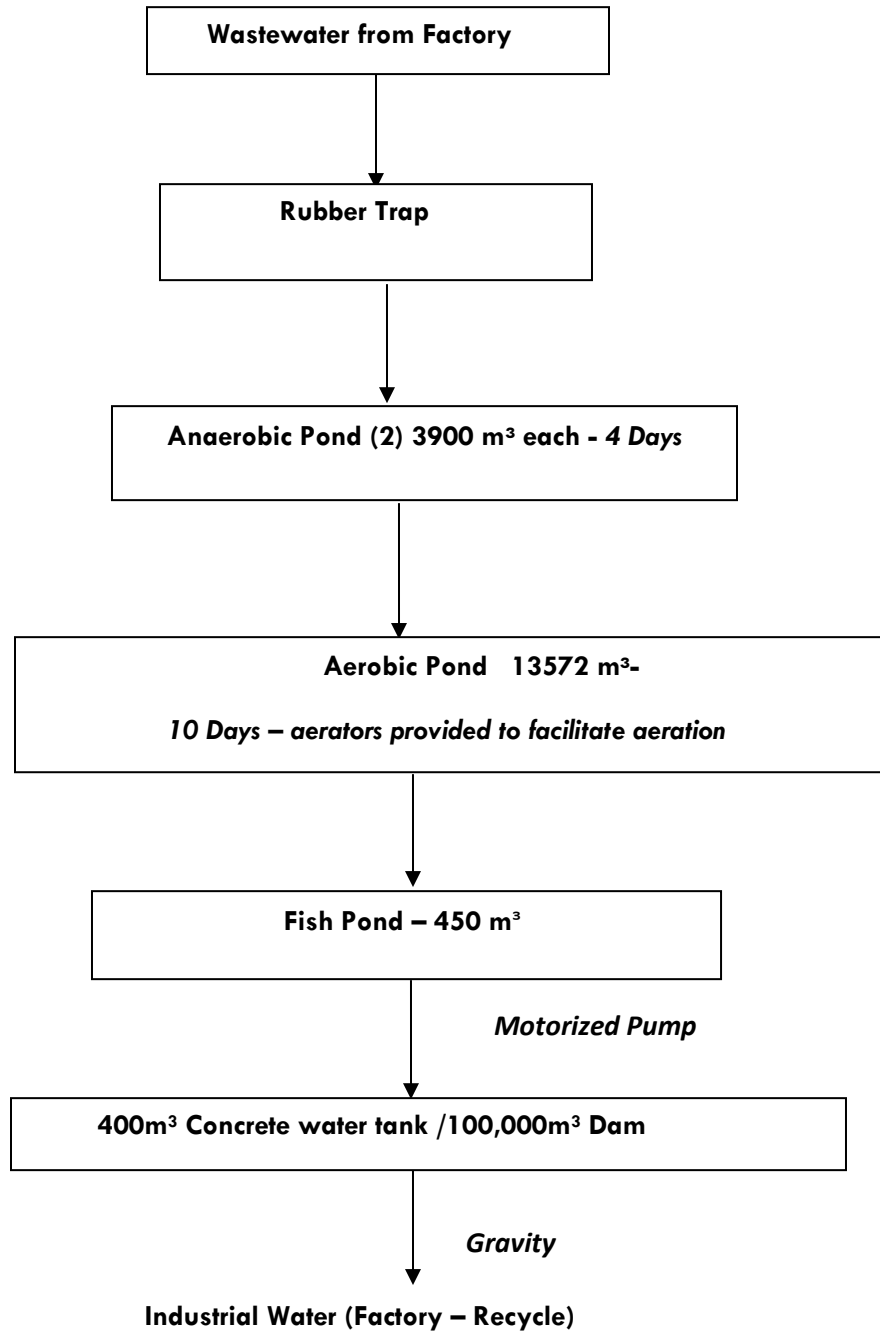


Figure 5. 1: Wastewater Treatment Flow Chart

5.2.3 Solid Waste Management

Existing GREL solid waste management plan implemented at its operational areas will be extended to the proposed project site.

Solid wastes to be generated include scrap iron sheets, cuttings, trimmings, plastic bags, chemical containers, office and kitchen waste etc. Management of these wastes are discussed below;

Empty Container, Sack and Scraps

Some empty metal and plastic containers will be reused on site after thorough cleaning. The scraps will be accumulated and packed for sale to licensed scrap dealers.

Empty buckets will be stored in a separate room. They will be recycled for other activities on the plantation after a thorough wash with detergents: e.g. Stimulant and acid containers are reused for the preparation of stimulant.

Some used plastic bags and plastic sheets from the factory will be sent to Ghana Rubber Products in Accra for recycling while the remaining and ice water waste bags will be added to the other solid waste currently being managed by ZOOMLION.

Office/ Kitchen Waste

Office waste including paper from offices and domestic wastes will be stored in waste containers on site. These will be managed weekly by ZOOMLION.

The sludge from the process tanks and treatment ponds will be dislodged and deposited outside the rubber trap for agricultural purposes.

5.2.4 Waste Oil Management

GREL waste oil management measures will be implemented at the proposed rubber processing plant operations. The waste oils will be collected and stored in oil Retention room. The waste oil will then be used at the plantation for the chain saw operations and the excess sold out to EPA approved dealers registered with the company.

5.2.5 Noise

The proposed rubber processing plant will utilize the latest technology, which will guarantee low noise levels. Noise will further be attenuated by the use of Mufflers and silencers as dampeners. Other existing measures that will be extended to the proposed facility area include:

- Check and maintain /adjust machines to suitable designed levels during weekend maintenance.
- Provide all factory workers with earplugs or earmuffs and
- Enforce use of earplugs/earmuffs.

5.2.6 Fire Preventive Measures

Fire prevention and fire-fighting consciousness during the operational phase is expected to be very high. To ensure the safety of life and property, the Ghana National Fire Service visited the project site and reviewed the project design document in order to advise on measures and facilities to be provided to ensure adequate fire coverage. The management of the facility will strictly adhere to all the recommendations made by the Ghana Fire Service to ensure users of the facility are sufficiently protected against fire hazards.

Fire extinguishers to be provided by the Fire Service will be periodically serviced and recharged to keep them in readiness for unforeseen eventualities. The servicing and recharging will be planned such that, adequate fire protection will be provided at all times on the premises.

There will also be a firefighting team in the facility whose members will be trained in the fundamentals of fire-fighting and fire control skills. The training would be organised by the Fire Service. The training would equip all employees with the correct skills in handling all firefighting

and fire control equipment that would be provided. In all areas where there are fire risks, fire-fighting equipment would be provided in quantity and positioned appropriately for easy access and use in the event of fire. Fire protection measures and equipment recommended by the Fire Service and incorporated in the project design include:

- Insulation of all electrical cables and equipment;
- Creation of passages/corridors on all sections for easy movement of persons and materials;
- Establishment of clear and concise evacuation procedures for emergency movement of persons and materials in time of threats or fire disasters;
- Acquisition and installation of adequate fire extinguishers at vantage points and training of all occupants to handle and operate them when the need arises;
- Yearly recharging of all fire extinguishers to make them always operational; and
- Provision of well designated emergency exits to provide easy escape.

5.2.7 Occupational, Health and Safety Concerns

Adequate and appropriate personal protective equipment (PPE) such as over coats/aprons, safety boots, nose respirators/masks, and hand gloves would be made available to workers for use. PPEs are used at workplaces where hazards cannot be eliminated at source, and where ordinary work clothes do not offer sufficient protection.

Appropriate personal protective equipment for the various process stages of work would be provided. All personnel on the project site would be sensitized practically in the use and application of any particular protective equipment that is required at any stage.

These will however be updated regularly. The dangers involved in not putting on the right gear will be explained to all persons. Strict adherence to personal protection regulations will be maintained on site. The selection of various protective equipment would be based on the various types and suitability for body, hand eye and face.

- **Body Protection:** To give protection against spillage or splashes every employee has been provided with overcoats. Boots and helmets would be provided at the appropriate work

station.

- **Hand Protection:** Appropriate hand protective gloves are provided for all workers where there are risks to the hands or the possibility of product contamination.
- **Eye and Face Protection:** Eye and face protective devices (goggles and eye glasses) would be provided to give protection from possible splashes.
- **Ear Protection:** Ear muffs and plugs would be provided at noisy work stations
- **Nose/Respiratory Protection:** Nose respirators/masks would be provided at the appropriate work station.
- **Awareness creation and Training:** All personnel will be required to complete the necessary training to comply with the standards set forth within the HSE guidelines of the company. Such training will include but not be restricted to:
 - Proper use of personal protective equipment
 - Safety Awareness training
 - Environmental Awareness training
 - Code of Business Conduct
 - Defensive driving
 - Firefighting training

In addition, first aid would be provided on-site for minor injuries/cuts. All serious injuries and ailments would be sent to the Effia-Nkwanta General Hospital.

5.2.8 Gaseous Emissions

The following gaseous emissions management measures implemented by GREL will be extended to the proposed project operations:

- Preventive maintenance of factory machines and equipment which includes generators, handling equipment and company vehicles. This means equipment will be serviced in a planned manner to keep them in good order for continuous operation and less pollution of the environment.
- The exhaust of the 2 – 1,500kva generators will be sited at a location that is about 10 meters high from the ground level to reduce pollution of exhaust fumes to the immediate surroundings.

- Use of fuel efficiency products to improve combustion efficiency and thereby minimizing pollution of the environment.
- In the operation of the dryers, optimum set points will continuously be determined on the burners to adjust the air / fuel ratio to achieve maximum combustion efficiency and less pollution. Annual maintenance and cleaning of the dryer components and compartments quarterly (when using gas oil) to reduce odour and particulate matter emission.
- The “Gas wash and bio-filter” facility attached to the dryers (as explained under odour management) enhances cleaner air emission.
- The factory premises will either be grassed or tarred to minimize dust emissions from vehicular movement.
- Ambient air quality and emission monitoring will be done every quarter and the results submitted to the EPA as part of the AKOBEN compliance measures.

6.0 ENVIRONMENTAL MONITORING PROGRAMME

6.1 Introduction

Monitoring is an important aspect of a project's environmental review following an EIA and the approval of the project by the statutory institution. Monitoring is used to determine the accuracy of impact prediction and efficacy of the mitigation measures. Predictive phenomena are often associated with uncertainties, and so are predictions of impact magnitude in EIA. Monitoring of environmental performance allows the verification of the predictions and also the identification of any unpredicted environmental and socio-economic changes. Monitoring programmes also provides input to project environmental reviews.

In the case of the proposed natural rubber processing facility, the effectiveness of the impact mitigation measures will be monitored to verify whether they work satisfactorily.

Through monitoring, the change in a predicted-observed impact situation can be assessed and reviewed. Where observed impact levels are found to be unacceptable, relevant remedial and/or additional mitigation measures would be implemented.

6.2 Monitoring Principles and Objectives

GREL will extend its existing monitoring programme to cover the proposed project area. The monitoring programme will have the following objectives:

- Verify that mitigation and control measures are operating efficiently and with their designed effect.
- Provide the information required for the continuous improvement in GREL's management practices and procedures, especially those pertaining to compliance and other areas of Health, Safety and Environmental (SHE) performance.
- Detect changes in the receiving environment and enable analysis of their causes.
- Enable effective liaison with the local communities, including addressing complaints and concerns.

6.3 Data Handling and Reporting

The monitoring programme will include a documented monitoring plan detailing all data handling and information on all sampling results as well as locations. The monitoring plan will identify the location where all data is to be held, staff responsibilities for data handling and analysis and appropriate reporting lines for ensuring management are aware of the current status of operations. The monitoring data will be analysed and summarized for reporting purposes to regulatory agencies.

6.4 Management Measures

Monitoring will take place in all the phases of the project construction and operational phases of the project. The action plan and the budget for environmental management is provided as Table 6.1. The following parameters will be monitored:

6.1. The following parameters will be monitored:

- Odour nuisance/Air Quality.
- Wastewater
- Solid waste.
- Waste oil.
- Noise control and
- Occupational Health and Safety.

6.4.1 Odour Nuisance and Air Quality Management Measures

The following odour nuisance and air quality monitoring measures will be extended to the proposed project site:

- Daily cleaning of cuplumps temporary storage area, pretreatment area and storage cubicles to prevent serum stagnation and fermentation
- Controlling the water hoses to reduce water wastage on the process
- Daily removal of rubber pieces & crumbs from interceptors
- Changing wooden chips during annual shutdown maintenance
- Ensuring dusty –free operations at the factory during the expansion projects
- Ensuring quarterly cleaning of the dryers
- Measuring Air quality level every quarter
- Prepare quarterly returns for EPA Akoben Programme and Annual Environmental report.

6.4.2 Wastewater Management Measures

The following wastewater monitoring measures will be extended to the proposed project site:

- Collection of ground rubber from the factory floor at the end of each shift.
- Collection of rubber crumbs from interceptors at regular intervals.
- Alternative use of Anaerobic Ponds 1 & 2 to maintain allowable retention.
- Sampling of water for analysis from the “Fish Pond”. and
- Compare effluent quality values with EPA Guideline values.

6.4.3 Solid Waste Management Measures

Solid waste generation and management will be monitored on a weekly basis during the operational phase to establish whether the existing GREL waste disposal systems extended to the proposed facility area are working effectively.

6.4.4 Waste Oil Management Measures

The following waste oil monitoring measures will be extended to the proposed project site:

- Ordering and storage of oils in the oil / lubricant stores
- Daily issues of oils / lubricants using standard measuring cans and recording
- Daily management of oil spills during issuing, handling and usage
- Provide staff with PPE's and tools
- Compilation of daily, weekly and monthly reports
- Maintenance of machines and oil top up, draining of oil /lubricants
- Servicing of rolling stocks and draining of oil and refilling
- Conveying drained (used) oil to the used oil storage room
- Recording stock of used oil and reporting
- Issuing out used oil to chainsaw operators or EPA approved dealers
- Management of spills

6.4.5 Noise Control Management Measures

The following noise monitoring measures will be extended to the proposed project site:

- Measure noise levels on the factory floor (emissions) and surroundings (ambient) every quarter.
- Check and maintain /adjust machines to suitable designed levels during weekend maintenance.
- Provide all factory workers with earplugs or earmuffs
- Enforce use of earplugs/earmuffs
- Prepare quarterly reports for EPA AKOBEN Programme /Annual Environmental report

6.4.6 Occupational Health and Safety Management Measures

Workplace accident and staff medical records will be kept on file. Safety measures will be reviewed bi-monthly to assess their effectiveness. Routine inspections of workplaces will be conducted to ensure health and safety controls and systems are maintained and appropriately employed. Deviations will be reported via the appropriate reporting systems for corrective action implementation.

Table 6. 1: Action Plan and budget for Environmental Management

Management Issue	Action/Parameters	Timeframe/ Frequency	Responsibility	Cost Estimate (GHC)
Oduor Nuisance/Air Quality	<ul style="list-style-type: none"> Air quality monitoring Submission of monitoring returns to EPA 	<ul style="list-style-type: none"> Quarterly 	<ul style="list-style-type: none"> GREL 	4,500
Wastewater	<ul style="list-style-type: none"> Sampling of water for analysis Submission of monitoring returns to EPA 	<ul style="list-style-type: none"> Quarterly 	<ul style="list-style-type: none"> GREL 	2,500
Solid waste	<ul style="list-style-type: none"> Solid waste segregation All domestic wastes will be stored temporarily in a skip bucket which is collected and sent to accredited landfill 	<ul style="list-style-type: none"> Weekly Daily 	<ul style="list-style-type: none"> GREL 	2,000
Waste oil	<ul style="list-style-type: none"> Maintenance of machines and oil top up, draining of oil /lubricants Recording stock of used oil and reporting Issuing out used oil to chainsaw operators or EPA approved dealers 	<ul style="list-style-type: none"> Monthly Daily Quarterly 	<ul style="list-style-type: none"> GREL 	1,500
Noise	<ul style="list-style-type: none"> Measure noise levels on the factory floor (emissions) and surroundings (ambient) 	<ul style="list-style-type: none"> Quarterly 	<ul style="list-style-type: none"> GREL 	2,500
Occupational Health and Safety	<ul style="list-style-type: none"> Staff medical screening Review of safety measures 	<ul style="list-style-type: none"> Annually Bi-monthly 	<ul style="list-style-type: none"> GREL 	8,000
Total				GHC21,000

7.0 PROVISIONAL ENVIRONMENTAL MANAGEMENT PLAN

In line with Best Practice Environmental Management, it is GREL's aim to manage the proposed natural rubber processing facility operations so that the undesirable (negative) environmental effects of the project during operations are minimised whilst positive effects are maximised. This section of the report presents the Provisional Environmental Management Plan (PEMP) for the natural rubber processing facility. The PEMP is a framework document that encompasses all aspects of mitigation, management, monitoring, and institutional measures that will be undertaken by GREL.

Under Section 24 of the Environmental Protection Agency Act 1994 (Act 490), LI 1652 Environmental Assessment Regulations, GREL is required to submit a detailed Environmental Management Plan (EMP) to the EPA within 18 months of the start of operations. Following the approval of this EIS, GREL will then apply to the EPA for an Environmental Certificate through the submission of the EMP.

7.1 GREL's Health, Safety and Environmental Policy

GREL has drawn up a Safety and Health policy to guide both the Management and the employees **“To protect the health and well-being of workers and ensure that safety is one of the main consideration”**.

We pursue the following policy objective:

- Ensure safety of workers and of the surrounding community establishing safety and emergency action plans.
- Ensure that health and safety issues are integrated into processes at all levels.
- Comply with safety and health laws and regulations.
- Ensure that appropriate training on health and safety are provided for all employees
- Ensure that all workers comply with the relevant health and safety procedures
- Ensure a working environment that motivate and support all employees in their effort to achieve zero work related injuries and illness.
- Follow safe work practice and procedures.

7.2 Environmental Staffing

The environmental department of GREL will be responsible for ensuring that the environmental management of the project is carried out in accordance with this EIS and other relevant legislations. This section outlines the existing management structure and the various responsibilities. The environmental manager will report directly to the facility site Manager, thereby ensuring that environmental issues are assigned the appropriate priority and level of attention.

The environmental department's responsibilities include:

- Directing and maintaining all environmental monitoring of the project
- Engaging regulators and stakeholders on environmental issues
- Overseeing the management of wastes generated
- Reporting as required in the EIS documents and other approvals obtained by GREL

To provide a high level of environmental awareness, GREL will communicate environmental and safety responsibilities to employees and contractors. GREL believes that all personnel have a Duty of Care to perform their work in a safe and environmentally sound manner as directed by Ghanaian law. In addition, all sectional supervisors will be accountable for implementing the environmental and safety standards in their units.

7.3 Monitoring Programme

GREL will monitor the environmental resources within the natural rubber processing area. Monitoring will also assist the management to take any corrective measure in case of deviation. The monitoring programme as outlined in Chapter 6 will cover the following areas:

- Oduor nuisance/Air Quality.
- Wastewater.
- Solid waste.
- Waste oil.
- Noise control and
- Occupational Health and Safety.

7.4 Financial Allocations

Funding for environmental management will be done directly from the proposed natural rubber processing plant project operating budget. Budgeting will be done annually, so as to allow planning and implementation of the environmental management needs for the project.

7.5 Decommissioning Plan

GREL is required to prepare and implement a decommissioning plan as part of its environmental management strategy. The decommissioning plan will be developed in line with the concepts presented in Chapter 8 of this report.

At this stage of project development, the decommissioning objective is conceptual. GREL will carry out stakeholder consultations before finalizing on the end uses for the proposed natural rubber processing facility site.

7.6 Emergency Response Plan

Existing GREL emergency response plan will be extended to cover operation of the new processing facility. The existing emergency response plan is discussed briefly below and the plan is attached as **Appendix 5**.

Emergency situations and action/response procedures

Types of emergency situations to be reported or responded by personnel are:

- Medical
- Fire
- Severe weather
- Chemical spill
- Structure climbing/descending
- Extended power loss

Medical Emergencies (including accidents)

- Call medical emergency phone number (*check emergency phone numbers of medical personnel and Hospitals*):

- Medical officer
 - GREL/National Ambulance
 - Hospitals
 - Others
- Provide the following information:
- Nature of medical emergency, including accidents
 - Location of the emergency (address, building, room number),and
 - Your name and phone number from which you are calling.
- Do not move victim unless absolutely necessary.
- Call a personnel trained in First Aid depending on location (**emergency numbers from 25 to 29**) to provide the required assistance prior to the arrival of a professional medical help:
- If personnel trained in First Aid are not available, **as a minimum**, attempt to provide the following assistance:
- Stop bleeding with firm pressure on the wounds (note: avoid contact with blood or other bodily fluids).
 - Clear the air passages using the **Heimlich Maneuver** (*is a first aid procedure used to treat upper airway obstructions (or choking) by foreign objects*) in case of choking.
 - In case of rendering assistance to personnel exposed to hazardous materials, consult the

Material Safety Data Sheet (MSDS) and wear the appropriate PPE.

- Attempt first aid ONLY if trained and qualified.

Fires/Explosions Emergency

When fire is discovered:

- Activate the nearest fire alarm (if installed)
- Notify the Emergency Coordination team by calling (*refer to **emergency personnel phone numbers***).
- If the fire alarm is not available, notify the work Area Head (Manager) about the fire emergency by the following means:
- Voice Communication
 - Phone calling

Fight the fire ONLY if:

- The emergency coordination team has been notified.
- The fire is small and is not spreading to other areas.
- Escaping the area is possible by backing up to the nearest exit.
- The fire extinguisher is in working condition and personnel are trained to use it.

Upon being notified about the fire emergency, occupants must:

- Leave the building using the designated escape routes.
- Assemble in the emergency Assembly point (location specific):
- Remain outside until the competent authority (Designated Officer) announces that it is safe to re-enter.

Work Area Heads, Emergency Coordinator or supervisors must:

- Disconnect utilities and equipment unless doing so jeopardizes safety precautions.
- Coordinate an orderly evacuation of personnel.
- Perform an accurate head count of personnel reported to the work area (especially the ROU and Abura offices, Factory work floor, Head-Office).
- Determine a rescue method to locate missing personnel.
- Call and provide the Fire Service with the necessary information about the facility in case of uncontrollable fires.

Work Area Heads must:

- Ensure that all employees have evacuated the area/floor.
- Report any problems to the Emergency Coordination team at the assembly point.

Assistance to Physically-Challenged:

- Assist all physically challenged employees in emergency evacuations.

Severe Weather and Natural Disasters

Lighting and Thunder driven Rain storms:

When a warning is issued by heavy rain storms such as lighting and thunder (*the warning signs should be monitored and communicated by the Security Manager*), seek inside shelter.

Consider the following:

- Small interior rooms on lowest floor and without windows especially those working in enclosed working areas.
- Tappers Sheds away from the tasks.
- For plantation workers, stay calm and await instructions from the designated Managers/supervisors.

- Rooms constructed with reinforced concrete, brick, or block with no windows.
- Stay away from outside walls and windows.
- You could consider using the arms to protect head and neck.
- Avoid contact with corded phones and devices including those plugged into electric for recharging.
- Remain sheltered until the rain storm threat is over.

Flood:*If indoors:*

- Be ready to evacuate as directed by the Emergency Coordination team member and/or the designated Work Area Head especially A-Lang camps.
- Follow the recommended evacuation routes.

If outdoors:

- Climb to high ground and stay there.
- Avoid walking or driving through flood water.
- If car stalls, abandon it immediately and climb to a higher ground.
- Make a telephone call to the appropriate personnel for help if the need be.

Chemical spill

The following are the locations of:

1. **Spill Containment and Equipment:** *GREL Agric and factory stores, Factory floor and workshop area, GREL Garage workshops, and GREL Fuel stations (Abura, Factory and Subri)*
2. **Personal Protective Equipment (PPE):** *Agric stores, Factory stores*
3. **MSDS:** *Spill containment and equipment working areas as stated in 1 above. When a*

Large Chemical Spill has occurred:

- Immediately notify the designated Manager or Supervisor and Emergency Coordination team.
- Contain the spill with available equipment (e.g., pads, booms, absorbent powder, sawdust, dry sand etc.).
- Secure the area and alert other site personnel.
- Do not attempt to clean the spill unless trained to do so.

- Attend to injured personnel and call the medical emergency numbers (depending on your location, if required).
- Call a local spill cleanup company or the Fire Department, if needed to perform a large chemical (e.g., Acid) spill cleanup.
- Evacuate building as necessary.

When a Small Chemical Spill has occurred:

- Notify the Emergency Coordination team and/or supervisor.
- If toxic fumes are present, secure the area (with caution tapes or cones) to prevent other personnel from entering.
- Deal with the spill in accordance with the instructions described in the MSDS.
- Small spills must be handled in a safe manner, while wearing the proper PPE.
- Review the general **spill cleanup procedures**.

Extended Power Loss

In the event of extended power loss to a facility, certain precautionary measures should be taken depending on the geographical location and environment of the facility:

- Electrical equipment and appliances should be turned off in the event that power restoration would surge causing damage to electronics and affecting sensitive equipment.

Upon Restoration of heat and power:

- Turn on lighting/electrical bulbs to verify voltage (low/high currents).
- If power surge is normal proceed to normalized all electrical gadgets, if not contact the emergency response team.

After close of work and/or out of office:

- All electrical appliances should be switched off in applicable.

7.7 Documentation and Reporting

The environmental department will collect monitoring data and issue reports as required by the environmental permits, environmental certificate, and the laws and regulations as applicable to the project.

7.7.1 Types of Reports

Three basic environmental reports would be required once the necessary authorisation is given for the project development. These are:

- Annual Environmental Reports: prepared for the attention of the EPA. The report will contain the compilation of the Company's monitoring activities and the results of the implementation of the relevant mitigation measures, training needs and community support and services. The report will be submitted to the EPA by the end of the first quarter of the following reporting year.
- Environmental Management Plan: prepared within 18 months of the start of development. The Provisional Environmental Management Plan in this EIS will provide the initial basic material for the first EMP. The EMP will be updated every 3 years and submitted to the EPA six months before the expiration of the certificate.
- Quarterly Monitoring Returns: returns covering environmental quality monitoring and waste generation among other things are to be submitted to the Agency by the end of the following month in line with LI 1652.

8.0 PROVISIONAL DECOMMISSIONING AND CLOSURE PLAN

The various natural rubber processing plant components are land use activities which are associated with site contamination. The exact level of contamination is, however, dependent on the standard of management practiced at the project site. All the project and related sites are therefore considered to be potentially contaminated. There are specific requirements relating to the decommissioning of these facilities. Decommissioning of the project facilities will generally commence with the notification letter to the Ghana EPA.

A review of the closure objectives of the identified project components will serve as background upon which the decommissioning plan of the project facilities will be laid. The closure objectives of the facilities are discussed in the following sub-sections.

8.1 Closure Objectives

The closure objectives for the proposed rubber processing operations require that the entire facility area will be removed and the site reclaimed and reverted to the original land use plan envisaged for the area viz. re-vegetation. The specific objectives for the project are:

- To dismantle and remove all structures and equipment which are not suitable for use by post facility land users;
- To ensure that the warehouse, storage shed, workshop, wastewater treatment plant, offices etc. are chemically and physically stable;
- To reduce the aesthetic impact of the reclaimed areas as far as is practical;
- To minimize or eliminate any post-reclamation environmental impacts; and
- To minimize or eliminate any post-reclamation maintenance or monitoring requirements for reclaimed areas.

8.2 Decommissioning Plan

The facility manager at post at the time that the decommissioning of any of the project facilities is due shall be responsible for the preparation and execution of the decommission plan according to law. The following elements will form part of the decommissioning plan:

- Background of the natural rubber processing facility
- Brief description of the site facilities and components

- Brief description of the site preparation for decommissioning including
 - Physical examination of site
 - Initial soil tests for Volatile Organic Compounds (VOCs)
- Brief description of on-site decommissioning process
 - Dismantling of surface installations e.g. pipes, pumps, sheds, electrical systems etc.
 - Draining of tanks, pipes
 - Safe transportation of residual products and pipes
 - Physical examination of surface mounted tanks in presence of EPA, NPA etc.
 - Haulage of tanks to appropriate storage
 - Soil and groundwater sampling and testing etc.
 - Demolishing of concrete slabs, platforms and Plinths

The steel shed, tanks, containers and piping infrastructure will all be dismantled and removed from site, whereas the concrete slabs, platform and oil separator will be demolished.

9.0 CONSULTATIONS

Consultations have been held with all the project relevant stakeholders. The comments and concerns of various stakeholders have been useful in identifying the implications, impacts, benefits and mitigation measures of the project. The following stakeholders have been consulted.

- Environmental Protection Agency (EPA);
- Physical Planning Department;
- Water Resources Commission;
- Ahanta West District Assembly; and
- Association of Chiefs on whose land GREL Operates

9.1 The Environmental Protection Agency (EPA)

Application forms were submitted to the Agency, which subsequently required the preparation of this EIS. Project site screening was carried out by the EPA office in Sekondi. Under the EPA legal and regulations stated above, the proposed natural rubber processing project falls under the category for which an EIA is required and the EPA in this regards issued a letter dated 13/04/2017 with reference CU: 1816/01.

In compliance with Ghana's environmental policy stipulated in Environmental Protection Agency (EPA) Act, 1994 (Act 490), and subsequent Legislative Instrument (LI) 1652 of 1999, GREL has submitted a scoping report and draft Terms of Reference (TOR) to the EPA. This was approved by the EPA in a letter dated 11/01/2018 with reference number 1816/01/04 and paved the way for the conduct of the Environmental Impact Assessment (EIA). The results of the EIA is this Environmental Impact Statement (EIS). (**Appendix 2**).

9.2 Physical Planning Department

The Physical Planning Department of the Ahanta West District Assembly indicated during a consultation with the department that the current land use for the project area is industrial and therefore can be used for the proposed intended project.

9.3 Water Resources Commission

GREL has sent a notification letter to WRC to use the Tsibu stream for the natural rubber processing plant. The request letter and the exiting GREL WRC permit is attached as **Appendix 3**.

9.4 Ahanta West Municipal Assembly

Management of GREL has informed the Ahanta West District Assembly as the highest political authority vested with powers to deliberate, legislate, plan and develop the metropolis. They, however, expressed delight for the establishment of the natural rubber processing plant as that will provide employment and also increase the revenue base of the assembly. This will then translate into development of the Assembly. They identified odour nuisance as the major negative impact from the project.

9.4 Association of Chiefs on whose land GREL Operates

The Company evolves in community projects and programmes through ACLANGO (Association of Chiefs on whose land GREL operates). GREL has the blessings of ACLANGO to undertake the project.

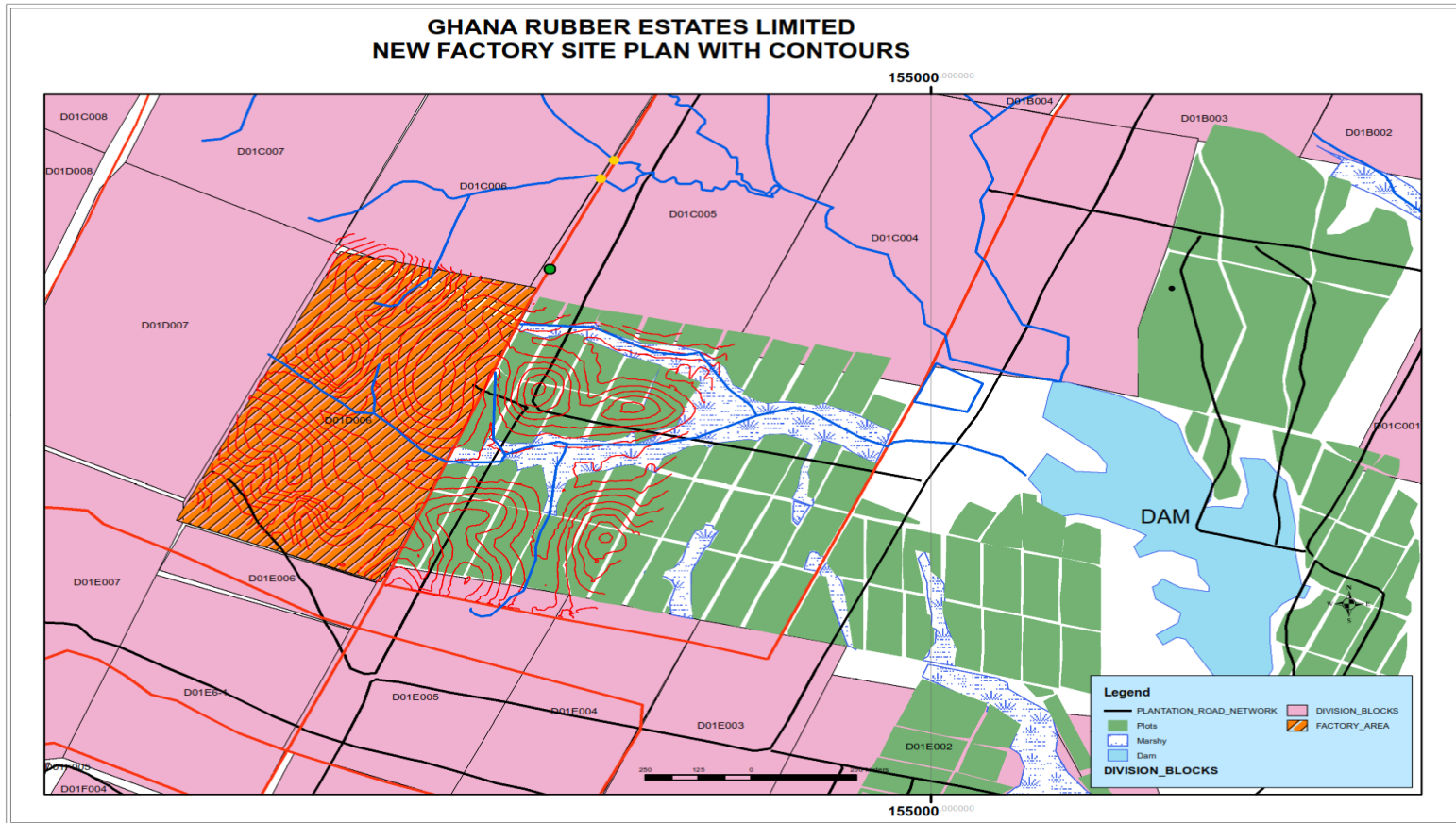
10 CONCLUSIONS

GREL has carried out an Environmental Impact Assessment (EIA) for the proposed natural rubber processing plant and has identified environmental impacts likely to be associated with the undertaking. Management has consequently put forward mitigation measures aimed at reducing and if possible eliminating the environmental impacts as required by law.

GREL will follow all the regulatory requirements in the country in order to effectively manage the proposed facility. It is the fervent wish of management of GREL that the project is implemented within a business framework that promotes environmental and economic sustainability in addition to social acceptance by all stakeholders.

LIST OF APPENDICES

Appendix 1: Project Site Plan



APPENDIX 2: EPA CORRESPONDENCES

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
Email: info@epa.gov.gh



Environmental Protection Agency

P. O. Box MB 326
Ministries Post Office
Accra

Website: <http://www.epa.gov.gh>

Our Ref: CU: 1816/01

April 13, 2017

The Managing Director
Ghana Rubber Estates Limited
P.O.Box TD 228,
Takoradi - Ghana

Dear Sir,

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
PROPOSED CONSTRUCTION OF A NATURAL RUBBER PROCESSING FACTORY AT
ABURA IN THE AHANTA WEST DISTRICT OF THE WESTERN REGION

We acknowledge receipt of the completed Environmental Assessment Registration Form (EA1) submitted to the Agency for the purpose of obtaining environmental approval for the above proposal in accordance with the Environmental Assessment Regulations 1999 (LI 1652)

The proposal falls in the category of undertakings (Regulation 3) for which Environmental Impact Assessment (EIA) is required to help understand the likely implications of the proposal, the relevant alternatives and mitigations to consider in order to ensure, sound decision-making and sustainable development of the project.

In line with Regulations 11 of LI 1652 however, you are advised to carry out a scoping exercise to generate the relevant terms of reference (TOR) to guide satisfactory EIA study of the proposal.

Please note that scoping is meant to focus the EIA on the key issues, concerns and decision areas and solicit input and guidance of all relevant stakeholders on the TOR. Scoping notices must be served as appropriate to facilitate stakeholder involvement (see attached sample). Ten (10) hard copies of the scoping report must be submitted to the Agency for study and agreement on the TOR, prior to the EIA studies.

It is important that the Scoping Report and Environmental Impact Statement contains information on the consultants who prepared the reports. This should include the names, address, email, telephone experience and their specific contribution to the study. Failure to provide this information would render the submission incomplete.

Do not hesitate to contact the Agency (Head Office Room 305) and the EPA Accra East Regional Office, Tema for any further guidance you may require in this regard.

Yours faithfully,

Kwabena/Badu-Yeboah
Ag. Director/EAA Division
For: Ag. Executive Director

cc: The Regional Director, EPA Western Region, Sekondi

Tel: (0302) 664697 / 664698 / 662465
667524 / 0289673960 / 1 / 2
Fax: 233 (0302) 662690
Email: info@epa.gov.gh



Environmental Protection Agency

P. O. Box MB 326
Ministries Post Office
Accra

Website: <http://www.epa.gov.gh>

Our Ref: CU: 1816/01/04

January 11, 2018

The Managing Director
Ghana Rubber Estates Limited
P.O Box TD 228
Takoradi-Ghana

Dear Sir,

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
PROPOSED CONSTRUCTION OF A NATURAL RUBBER PROCESSING FACTORY
AT ABURA IN THE AHANTA WEST DISTRICT OF THE WESTERN REGION


We refer to the Scoping Report on the above proposal submitted to the Agency for the purpose of obtaining environmental approval in accordance with the Environmental Assessment Regulations 1999 (LI 1652).

The report has been reviewed and found to be generally satisfactory. You are therefore advised to proceed with the EIA study and submit **eight (8) hard copies** of the draft Environmental Impact Statement taking into account the attached comments in accordance with the Environmental Assessment Regulations 1999 (LI 1652).

In accordance with the Fees and Charges (Amendment) Instrument, 2015 (LI 2228), you are required to pay a **non-refundable processing fee of Ten Thousand Ghana Cedis (GHS 10,000.00)** as per the attached invoice. The payment must be made at **any ECOBANK Branch** by presenting the attached invoice. Kindly submit a copy of the Ecobank receipt to Room (305) EPA Head Office after payment.

Do not hesitate to contact the Agency for any further assistance or guidance you may require in this regard.

Yours faithfully,


KWABENA BADU-YEBOAH
AG. DIRECTOR/EAA DIVISION
FOR: EXECUTIVE DIRECTOR

Attached:

APPENDIX 3: GREL CORESPONDENCE TO WRC



Ghana Rubber Estates Limited

REF.NO: 2018/HR/EXT./APB/ 073

Date: 23rd May, 2018

The Executive Director
Water Resources Commission
ACCRA.

Dear Sir,

NOTIFICATION TO USE TSIBU STREAM FOR INDUSTRIAL PURPOSES

This is to officially inform you of Ghana Rubber Estates Limited's (GREL) intention to use the Tsibu stream for industrial purposes. This has become necessary due to the decision by the management of GREL to site another Natural rubber (NR) Processing Factory within the catchment area.

The Company as at today have a permit (GRELID227/1/17) on the said stream for irrigation purposes and as such would want to add its request for industrial purposes during the permit renewal process in September 2019.

GREL intends to start running the proposed NR Factory in September 2019.

Counting on your usual cooperation and advice.

Yours faithfully,


LIONEL BARRE
MANAGING DIRECTOR

NB: Please find attached current water use permit for the Tsibu Stream.

WATER RESOURCES COMMISSION



Permit No: GRELID227/3/17

WATER USE PERMIT

This is to certify that a Water Use Permit has been issued to:

GHANA RUBBER ESTATES LIMITED

To abstract raw water from Tsibu and Huni stream at Apimanim in the Ahanta West District of the Western Region for irrigation as per attached schedule

Commencement: January 1, 2017
Validity Period: 3 Years
Expiry Date: December 31, 2019


BEN. Y. AMPOMAH
EXECUTIVE SECRETARY

This Permit is issued in accordance with the Water Use Regulations 2001, LI 1692 and is only valid with the Seal of the Water Resources Commission

Appendix 4: List of Project Machinery with Installed Design Capacities

Package #1: PRE-TREATMENT

1. Slab cutter #1

- Capacity (dry rubber): 10 T/h
- Feed mouth :
 - i. Length 1600 mm minimum
 - ii. Width 1100 mm minimum
- Transformed product
 - i. Thickness of rotating knife: from 38 mm to 51 mm
 - ii. Teeth height 180 mm minimum
 - iii. Double teeth
 - iv. Outer diameter of the rotor 600 mm or more
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety: Log out, tag out mechanical system to be considered for manual operation purpose.

2. Vibrating Screen #1

- Capacity: 10 T/h
- Exit width: 1200 mm
- Equipped with parallel bar screen, not holes.
- Equipped with support.
- Safety to be considered.

3. Metal Conveyor #1

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel.
- Plate thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No in-running angle without protection.

4. Tank #1

- Out of scope

5. Screw Conveyor #1

- Capacity: 10 T/h
- Length: 4000 mm
- Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.
- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered.

6. Hopper #1

- Out of scope

7. Rotating Drum #1

- Capacity: 10 T/h
- Length: 4000 mm or more
- Diameter: 1500 mm
- Thickness: 2 mm
- Holes
 - i. Size of the holes: Oval holes 20x40mm
 - ii. Density of holes: 60% void, 833 holes per m²
- Inclination: Adjustable between 0 and 5 %
- Equipped with support.
- Equipped with 3 water sprayers ramp.
- Rotating on the central axle of the drum preferred.
- Safety to be considered.

8. Tank #2

- Out of scope

9. Screw Conveyor #2 & #3

- Quantity: 2
- Capacity each: 6 T/h
- Dimension each:

- i. Length: 4000 mm
 - ii. Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.
- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered.

10. Vibrating Screen #2 & #3

- Quantity: 2
- Capacity each: 6 T/h
- Exit width each: 800 mm
- Equipped with parallel bar screen, not holes.
- Equipped with support.
- Safety to be considered.

11. Picking Conveyor #1 & #2

- Quantity: 2
- Capacity each: 6 T/h
- Dimensions
 - i. Length: 4000 mm
 - ii. Inside width: 800 mm
 - iii. Max belt height from ground: Max 700 mm
- Rough top rubber belt to be considered, under the outlet drum.
- Spray water washing to be considered, under the outlet drum.
- Equipped with support.
- Safety: No trap-in angle without protection.

12. Tank #3

- Out of scope.

13. Screw Conveyor #4

- Capacity: 10 T/h
- Length: 4000 mm
- Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.

- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered.

14. Creper #1

- Capacity: 10T/h
- Grooving of the roll: To be specified by supplier
- Equipped with motorized feeding roll
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Safety to be considered.

15. Metal Conveyor #2

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel.
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No in-running angle without protection.

16. Tank #4

- Out of scope.

17. Bucket Elevator #1 & #2

- Quantity: 2
- Capacity each: 10 T/h
- Length: 4000 mm
- Chain type: European standard
- Equipped with support.
- Safety to be considered.

Package #2: CLEANING

1. Slab Cutter #1

- Capacity (dry rubber): 10 T/h
- Feed mouth :
 - i. Length 1100 mm
 - ii. Width 800 mm
- Transformed product
 - i. Thickness of rotating knife: 25 mm
 - ii. Teeth height 100 mm
 - iii. Outer diameter of the rotor 600 mm or more
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety: Log out, tag out mechanical system to be considered for manual operation purpose.

2. Vibrating Screen #1

- Capacity: 10 T/h
- Equipped with parallel bar screen, not holes.
- Equipped with support.
- Safety to be considered.

3. Tank #1

- Out of scope.

4. Screw conveyor #1 & #2

- Quantity: 2
- Capacity each: 6 T/h
- Dimension each:
 - i. Length: 4000 mm
 - ii. Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.
- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered.

5. Picking Conveyor #1 & #2

- Quantity: 2
- Capacity each: 6 T/h
- Dimensions
 - i. Length: 4000 mm
 - ii. Inside width: 800 mm
 - iii. Max belt height from ground: Max 700 mm
- Rough top rubber belt to be considered.
- Spray water washing to be considered, on the outlet side drum.
- Equipped with support.
- Safety: No in-running angle without protection.

6. Tank #2

- Out of scope.

7. Screw Conveyor #3

- Quantity: 1
- Capacity each: 10 T/h
- Dimension each:
 - i. Length: 4000 mm
 - ii. Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.
- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered. Especially a cover on the higher part must be considered.

8. Wet Pre-Breaker #1

- Capacity: 8 T/h
- Size of Die Holes: 40 mm, cylindrical.

9. Vibrating Screen #2

- Capacity: 10 T/h
- Equipped with parallel bar screen, not holes.
- Equipped with support.
- Safety to be considered.

10. Tank #3

- Out of scope

11. Screw Conveyor #4

- Quantity: 1
- Capacity each: 10 T/h
- Dimension each:
 - a. Length: 4000 mm
 - b. Diameter: 600 mm or more
- Casing: Stainless steel
- Equipped with a screen bar at the bottom part.
- Equipped with support.
- Equipped with adjustable inclination. Optimum working angle to be specified by supplier.
- Safety to be considered.

12. Wet Pre-Breaker #2

- Capacity: 6 T/h
- Size of Die Holes: 25 mm, cylindrical.

13. Tank #4

- Out of quote

14. Bucket Elevator #1 & #2

- Quantity: 2
- Capacity each: 10 T/h
- Length: 4000 mm
- Chain type: European standard
- Equipped with support.
- Safety to be considered.

14. Metal Conveyor #1

- Capacity: 10 T/h
- Length: 3000 mm
- Inside width: 800 mm
- Plates in stainless steel.
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10

- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No in-running angle without protection.

Package #3: CREPING LINE.

1. Creper #1

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (with identical gearboxes, maximum 2 models of gearboxes (ratios) for the whole line
- Equipped with breaker pin coupling.
- Equipped with Feeding roll.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

2. Metal Conveyor #1

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel.
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

3. Creper #2

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

4. Metal Conveyor #2

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

5. Creper #3

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.

- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

6. Metal Conveyor #3

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

7. Creper #4

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

8. Metal Conveyor #4

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Speed to be defined by Supplier
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

9. Intermediate Shredder

- Frame Capacity: 10 T/h
- Installed roll capacity: 6 T/h
- Equipped with Feeder Roll – variable speed to be foreseen
- Main roll must have 2 identical shaft stubs to allow for using the roller in both directions of rotation.
- Grooving of the roll: To be specified by supplier
- If auto adjustment of the blade is available, the Supplier must describe the system
- Equipped with support.
- Noise insulation.
- Safety to be considered

10. Tank #1

- Out of scope

11. Bucket Elevator #1

- Quantity: 1
- Capacity each: 10 T/h
- Length: 4000 mm
- Chain type: European standard
- Equipped with support.
- Safety to be considered.
- Bucket elevator should be able to handle 2 types of products :
 - i. From Slab Cutter

ii. From Intermediate Shredder

12. Wet Pre-Breaker #1

- Capacity: 6 T/h
- Size of Die Holes: Between 15 mm and 18 mm, cylindrical. The Supplier must confirm feasibility.
- Machine to be feed with small crumbs from the shredder

13. Metal Conveyor #5

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

14. Creper #5

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with Feeding roll.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

15. Metal Conveyor #6

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

16. Creper #6

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

17. Metal Conveyor #7

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.

- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

18. Creper #7

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier
- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

19. Metal Conveyor #8

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

20. Creper #8

- Max Capacity: 10 T/h
- First step capacity limited to: 6 T/h. No change of roll expected between 6 T/h and 10 T/h. Speed to be specified by the supplier.
- Grooving of the roll: To be specified by supplier

- Each roller equipped with a motor, motors on opposite side (identical gearboxes and maximum 2 types of gearbox (ratios) for the whole of the line).
- Equipped with breaker pin coupling.
- Equipped with support.
- Safety to be considered.
- Equip chassis with stainless steel wear plates and intermediate support between the bearing blocks.
- Equip the chassis with big size water evacuation gutters to guide water to outlet spouts
- Equip the machines with adjustable side plates to regulate the width of the blankets

21. Metal Conveyor #9

- Capacity: 10 T/h
- Length: 7500 mm
- Inside width: 800 mm
- Plates in stainless steel
- Plate's thickness: 3 mm minimum
- Nb of teeth for sprocket: 10
- Chain pitch: 100 mm
- Equipped with support.
- Equipped with adjustable inclination.
- Safety: No trap-in angle without protection.

22. Final Shredder

- Frame Capacity: 10 T/h
- Installed roll capacity: 6 T/h
- Equipped with Feeder Roll – variable speed to be foreseen
- Main roll must have 2 identical shaft stubs to allow for using the roller in both directions of rotation.
- Grooving of the roll: To be specified by supplier
- If auto adjustment of the blade is available, the Supplier must describe the system
- Equipped with support.
- Noise insulation.
- Safety to be considered

23. Tank #2

- Out of scope

- Cooled to reduce/avoid using lime
- Magnet at the bottom. Removable solution to be considered

24. Vortex Pump for rubber transfer

- Capacity: 10 T/h

Package #4: DRYING.

1. Trolley Dryer #1 & #2

- Feeding station
 - Quantity: 1
 - Minimum Capacity 10 T/h
 - Vibrating screen (dimensions to be specified by supplier)
 - Hopper (dimensions to be specified by supplier)
- Dryers
 - Twin dryer or 2 separate dryers
 - Drying capacity, each: 5 T/h
 - Maximum temperature inside the cake, at off-loading: 40 deg C
 - Cooling capacity after drying, each: To be defined
by supplier, to reach the 40 Deg Celsius specification
 - Trolleys are pushed by 2 chains, for each dryer
 - Centre distance between the 2 rails 4800 mm
 - Pushers in stainless steel
 - Rubber seals between compartments reinforced : Lifetime 1 year min
 - All structure and lining in stainless steel.
 - Minimum of 3 access doors for maintenance inside each dryer
 - 5 sampling doors, for each dryer.
 - Temperature recorder on 5 points, located at the level of each sampling doors.
 - Cooling fan equipped with silencers
 - Burner brand: Weishaupt
 - Burner type: 10 TGas
 - Safety switch for burner temperature
 - Fire fighting device to be considered
 - Insulation: Temperature on wall surface < 40 deg (with rigid rockwooll).
- Trolleys

- Inside nb of trolley: To be defined by supplier
- Additional outside nb of trolleys = Inside nb of trolleys
- Reinforced chassis
- Deflector between the chassis and the frame, to avoid right angle corner.
- External dimension w/o wheels 4850 mm * 1440 mm * 500 mm
- Trolley type: Open top trolley
- Number on each trolley (from 1 to....)
- Number place on the right & left side of each trolley
- Arrow on both side on each trolley showing the entrance way
- Material of trolleys: Top part in Stainless Steel
- Off-loading station
 - The supplier is requested to propose an ergonomic solution for offloading.
- 2 return ways for trolleys.
- All Electrical equipment, control panel and cabling included.
- Mimic diagram (synoptic)
- Safety :
 - Asbestos forbidden
 - Access & protected walkways to be included
- To be checked during the commissioning (mini 1 week)
 - Capacity @ 5 T/h
 - No white spot
 - Consumption \leq 27 kg LPG / T

2. Trolleys cleaning Station

- Capacity of cleaning: 80 trolleys / day
- Electrical power
- Safety to be considered (max temperature, cover, ...)
- Ergonomics to be considered (lifting equipment, ...)
- Technology as per the supplier proposal, to be discussed

Package #5: BALING.

1. Scale

- Out of scope

2. Presses

- Overall capacity: 6 T/h

- Nb of Presses to reach the capacity: To be defined by Supplier
- Operating pressure: 180 bar
- Press type: Bottom-Up (preferred) or Top-Down
- Size of the bale at the exit of the press (L x W x H): 700 x 350 x 180 mm
- Manual system should not be accessible to operator (switch and sensor).
- One complete spare press to be included.
- Safety and ergonomics to be considered.

APPENDIX 5: EMERGENCY RESPONSE PLAN